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Title: How can computer simulated visualizations of the built environment facilitate better public participation in the planning process?

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INTRODUCTION

1.1 HYPOTHESIS

'Urban simulations; that is computer generated simulations of the built environment, are an effective means of improving the public's participation in the planning process'.

1.2 AIMS

The main direction of the paper will be to study how these urban simulations of the built environment are being used to improve the public's involvement in the planning process. The aim of this paper is to also provide an insight into what technology is currently being used by the planning world to create computer models of the urban landscape. It will assess and evaluate what current projects and models are currently available and how they are being distributed and made accessible to the public. The paper will conclude whether urban simulations are an effective means of improving public participation and explain any drawbacks that are associated with them.

1.3 OBJECTIVES

The objectives of this paper are:

- To provide a sufficient and in-depth study on how urban simulations are improving community involvement in the planning profession;
- To provide a clear and well informed explanation of urban simulations;
- To show a range of examples of urban models created from around the world and to provide a valid and well informed analysis of their use as a communication tool to aid better public participation;
- To involve the views of a diverse range of experts, academics, creators of models, to provide a well balanced and un-biased judgement;
- To critically review a wide range of literature to arrive at a well informed analysis of the title question.

1.4 RESEARCH QUESTIONS

- What is the importance of visualization in the planning process?
- To what extent can computers improve the traditional methods used by planning professionals to visually represent ideas to the public?
- What are urban simulations?
- What technology is mainly being used for the production of these models?
- How are these models being distributed?
- How many simulated models are there currently in the world?
- What countries are leading the way in the field of urban modelling?
- How good are current models available?
- What advantages do these models have to the public?
- What advantages do these models have to the planner?
- What other uses do these models have?
- Why have these models been produced, purely for the urban planners?
- Who are developing these urban models: public bodies, the private sector, universities?
- What technology is available to make these urban models?
- How are digital technologies improving the democratic system?
- What are the drawbacks of using urban simulations to visually represent ideas to the community?
- What possible things can restrict the development of computer generated urban simulations?

1.5 RESEARCH METHODS

The paper has primarily drawn upon case studies of urban simulations. Using projects and models of urban environments has allowed a comprehensive study of the subject question. The case study approach was taken for this paper due to the very nature of the question. With a study of modern technology and the use of computer models it is more difficult to obtain up to date relevant literature. Due to the ever changing and ever advancing technological world, accompanying research can often become outdated very quickly. It is for this reason it was wise to look at case studies throughout the paper to provide an analysis of the current situation in planning by using examples and projects to support and back up research. The case studies included in this paper have been chosen to provide a balanced cross section of work undergone in the field from around the world, particularly the reasons for each study will be explained therewith. Information collected on the case studies was usually accessed via research and literature made available on websites, as well as interviews with those involved.

To complement and provide further discussion on the case studies a number of experts were questioned with only a brief number of questions, so as to expect a reply. The experts ranged

from academics to professionals in creating computer models and were contacted via email, considering a number of those interviewed worked around the world. The use of interviews was purely as a back up to other research and hence does not form a results chapter in it's own right, instead the views of various people are placed where relevant into the text. The questions used were designed to provide a brief overview of their opinions and views on the success of urban simulations in planning.

1.6 STRUCTURE

1 **Introduction;** includes the hypothesis, aims and objectives, research questions and methods to provide an introductory analysis, providing the direction and targets for the paper.

2 **Public Participation;** the paper will begin by providing a brief introduction to the concept of public participation in the town and country planning profession. The section will provide an insight into the current method of public participation and highlight the importance of the public's role in the planning process.

3 **Visualization;** a review of the importance and role of visualisation in planning and its importance for public participation.

4 **Computer aided visualization;** an explanation of how computers can aid this process of visualization.

5 **Urban simulations;** the use of computers as a visual aid has lead to the concept of urban simulations, computer models of the urban landscape. Three of the numerous ways available for creating these urban simulations will be explained and their use for public participation is reviewed. The three modelling methods reviewed are CAD models, 3-D GIS and virtual reality models.

6 **Using urban simulations for public participation;** the importance of these urban simulations for increasing the number of people involved in the planning process and facilitating better communication between all parties. A small range of case studies will be used in this section to show the current uses and benefits of urban simulations.

7 **Virtual Cities;** a number of cities around the world have had 3-D models created of them for a number of purposes. Three city models will be reviewed and assessed as to their importance for the planning world. The three city models have been created for Los Angeles in America and Bath and London in the United Kingdom.

8 **Using the World Wide Web for public participation;** an assessment of the role played by the internet as a communication tool to distribute urban simulations to a wider public audience.

9 **Digital Democracy;** how modern digital technologies are improving the democratic system and the role of urban simulations in this process. This section will draw on a number of case studies which use urban models to gage the opinions and views of the public.

10 **Conclusion;** a round up of material and the author's personal opinion.

PUBLIC PARTICIPATION

Tell me, I forget.
Show me, I remember.
Involve me, I understand
(Moore and Davis, 1997)

Public participation in environmental decision making and the planning system in the UK has a relatively lengthy history. Ever since the first Town and Country Planning Act in 1947 varying degrees of public participation have existed in the UK planning system although it was not until 1969 (Skeffington, 1969) that widespread public participation became embedded in the process.

Dandekar suggests that involvement of the public to stimulate good ideas and build a consensus amongst a diverse community requires three modes of communication: *presentation of information to the public; receipt of information from the public; and exchange of ideas and opinions that build upon shared information as the ideas evolve* (Dandekar, 1982). The traditional method of public participation involves the use of public meetings. These are regarded by most as an inefficient, unfair and unproductive method of involving the public in the planning process. Members of the public who attend these meetings often experience difficulty understanding the spatial relationships portrayed on 2-D maps and plans, their frustration often leading to miscommunication and mistrust of planners. The importance of the public's participation in the process is tantamount in avoiding further conflict and objection once a development has been undertaken

The picture is worth a thousand words and direct involvement in most endeavours results in a greater understanding of the experience (Howard, 1998). Unfortunately the wisdom of this phrase has not fully been understood by the planning world as yet. The message here is clear, greater involvement in the planning process leads to greater understanding and acceptance of plans and proposals. Therefore any process which will improve the relationship between planners and the community they serve will inevitably result in a more fair and efficient planning system.

VISUALIZATION IN THE PLANNING PROCESS

The Picture Is Worth a Thousand Words
(Confucius, Chinese philosopher)

Visualization is an extremely important part of the urban planning process. It is estimated that 50 percent of the brain's neurons are involved in vision, and according to Van Driel (1989) 3-D displays can stimulate more of these neurons and hence involves a larger portion of the brain in the problem solving process. The traditional 2-D contour models which have been used in the planning profession since it's establishment demand that the viewer's mind first builds a conceptual model of the relief before it can be analysed, which *can be an arduous task for even the most dextrous mind.* Thus, 3-D computer models can stimulate spatial reality, thus allowing the viewer to more quickly recognize and understand changes in elevation. Several pieces of research in the past have questioned the public's ability to understand a map that is essentially a 'birds-eye' view of a place (Monmonier 1996, Keates, 1996). Many people do not instantly recognise a location when it is presented to them as an aerial view.

In the planning world, *the way planners and urban designers think about and communicate their ideas about urban problems and their solutions is strongly, although not exclusively, visual* (Batty, 1998). According to Langenorf (1992) visualisation of urban planning and urban design is based on three premises:

1. To understand nearly any subject of consequence it is necessary to consider it from multiple viewpoints, using a variety of information;
2. Understanding complex information about urban planning and urban design may be greatly extended if the information is visualised;
3. Visualisation aids communication with others.

As visualization takes place at every stage of the design process Batty and others (1999) have devised a rudimentary classification system, the main area of distinction being between forward and backward visualization. *Backward visualization involves developing visual tools and imagery which support experts and professionals, while forward visualization supports a less informed constituency, the public at large, but more specifically particular interest groups* (Batty, Dodge, Jiang & Smith, 1999). This paper will look at the process of forward visualization. *Simulated depictions of visual ideas have always been an important tool in landscape architecture. The potential realities contained within a designer's imagination have been revealed through models, maps, plans, etc (*Watzek & Ellsworth, 1994). The numerous

ways in which an idea may be displayed and how the user may interact with it can be seen overleaf, in *figure 1*.

	PASSIVE	**ACTIVE**
SIMULATING	Modelling: e.g. simulation on the Desktop	Modelling and Changing: e.g. immersive VR models of cities
EXPERIENCING	Observing: e.g. exploring maps, designs	Engaging and Changing: e.g. immersive & web-based worlds
COMMUNICATING	Displaying: e.g. reading web sites	Delivering: e.g. making decisions about services

FIGURE 1: Different types of visual communication and user interaction

Traditional methods of visually simulating the urban environment have come under criticism. They have been the subject of intensive studies (Mahmoud, 1998) which criticised their lack of important features that affected their reliability in predicting the real environment, such as the depth of visual field and passive interactivity. One such study was carried out by Pomeroy et al (1989) who studied photographs as a traditional simulation technique that has been used and recommended by most researchers examining public response to the aesthetics of the built environment. This has lead the planning profession to demand a new experiential, dynamic approach, which it is thought computers can provide. This new digital approach to visualization will be studied in the following section. Alan Hall says, *traditional planning techniques are time consuming, focusing on experts' judgement and often addressing superficial rather than fundamental issues due to lack of resources and the poor methods used in conveying the relevant information. Rendered images and more recently photomontage and even computer animations of proposed schemes are bound to views submitted by the designers (*Hall, 1996)

With communication and visualization at the heart of the planning system, the modernization of such a system currently residing in the two-dimensional form is an important issue in the planning world. Visualization is now regarded as the most significant of all activities in the design process to have been affected by the development of digital technologies. Many impressive examples, some of which will be seen later in this paper, have resulted in the last decade as planning professionals have led the way by embracing new digital technologies. Indeed, most of the other social sciences and intellectual institutions have been slow due to the culture of computing which can be alien to them.

COMPUTER AIDED VISUALIZATION

From Pasteboard to chipboard

One way that will be examined henceforth is the use of computers as visualization tools that enable the public to see how new land-use and other policies can change their built environment. Computer simulation involves computer modelling and photographic imaging techniques designed to illustrate the potential results of planning, development and design projects, *the ability to rapidly sketch and visualize design ideas is an important task in planning and urban design* (Singh, 1996). This technique provides participants with an ability to visualize the outcome of a design or planning action and assess its desirability before implementation.

Computer graphics in urban planning have developed considerably since the 1970s when visualizations of large scale artefacts were esoteric, static affairs that simply provided snapshots of real or imagined structures with little or no user interaction other than through offline preparation of data and designs. The concept of computer-aided design (CAD) began soon after microcomputers were invented. Computers have been used in urban planning research for almost three decades (Mitchell, 1996), although adoption by practitioners has been slow mainly due to software and hardware limitations. Three-dimensional computer models have developed significantly during the last decade due to *the expansion of high-resolution input and output devices and the vast increase in raw computing power* (Bourdakis, 1997)

When computers are applied in planning design, soon 3-D hidden-face removed images, shading images and rendering images replace traditional manual effect drawings. 3-D animation then offers a more advanced measure to visualise planning design schemes. A dynamic picture is definitely far more impressive than a static drawing, offers much more viewpoints and has much stronger psychological power to impact laymen.

Although we might develop an entirely automated form of design through computation at every stage of this process, the CASA team (Batty, Dodge, Jiang & Smith, 2000) have classified five key aspects of the process where digital tools might best be developed. These involve:

- Representing the geometric and geographic form of the system in question in terms of buildings, streets, land uses, etc, at different geographic-geometric scales, and using different types of media;

- Modelling movements and relationships between the various components of the built environment;
- Enabling the designer to sketch different alternative designs which address the problem in question;
- Visualizing the 2-D map geometry or geography in 3-D at different scales;
- Tying together all this various software in a networked participatory digital environment - a virtual design studio - where various users might participate and collaborate in the process of design.

Information is only powerful when it is effectively comprehended by those who use it. Information technology (IT) can help people to comprehend information, thereby delivering knowledge (Shiffer, 1996). Levy explains how it is simple enough to use CAD to insure buildings do not exceed heights and setbacks or to evaluate space allocated for a specific use. However, to be effective, planners as well as all other interested parties, including development officers, developers and the public, need access to these virtual environments. He instead sees the future as, the real potential of CAD is that it can offer a common meeting ground for negotiation among all concerned parties: city officials, property developers and members of the community. Ultimately visualisation technology can assist in negotiations by focusing on the look and feel of a project rather than on whether it meets every aspect of a bylaw (Levy, 1998). Below, figure 2 shows two impressive examples of how computer simulated models are being used to aid visualization in the planning process.

FIGURE 2: The Bath model; an example of the use of computers to aid visualization

URBAN SIMULATIONS

Using Computers to simulate the built environment

Imagine a world where citizens and decision makers had access to visual displays of geographic information on their personal computers that help them see the impact of different policy choices upon the area that they live. Imagine a world where three-dimensional graphic representations of cities could simulate different choices and show you different futures. *Imagine your city or simply your neighbourhood as a virtual world where you can walk, drive or fly safely anywhere, and experience your environment as it existed ten years ago, or as it might look in the future after physical changes are made* (Jepson, 2001).

The technology available to do this exists now. Technology previously exclusive to advanced military and aeronautical applications is now becoming available to urban planners to map the urban landscape, as computers are ever advancing and prices becoming ever more affordable. Visual simulation technology makes it feasible for planners and community groups to visualize and evaluate proposed changes and new developments in the urban environment. The importance of urban simulations is proving crucial for almost all design professions for presenting simulations of reality to the observer to predict their responses of the real situation The benefits of using computer simulations has been experienced at all stages of the planning process and by a wide range of professions from emergency services to telecommunications companies.

There are numerous ways currently being developed to effectively simulate the built environment, three of which will be assessed in this section. These modelling methods all have their pros and cons in benefiting the communication between planners and their communities. However, some experts believe the sheer number of modelling techniques

available may cause a hindrance rather than be beneficial to their development in the planning process. One such person is Narushige Shiode, *perhaps we have too many of them, and because each project is developing at such rapid speed, few people seem to pay attention to what others are doing (beyond their immediate neighbours with whom they compete for obvious market reasons). This in turn is hindering the establishment of a standard, and ultimately may prove to be an obstacle* (Shiode, 2001).

CAD MODELS

traditional block modelling

Solid, geometric modelling has traditionally been seated in the domain of specialist computer-aided design (CAD) packages. Three-dimensional modelling for planning and architecture usage is normally in the realms of traditional CAD packages such as *Microstation* or *AutoCAD*. These packages, whilst often achieving a high degree of realism in modelling urban environments, tend to be limited to operation on single machines running the expensive proprietary software, hence restricting access where available, to fixed problems or planning design issues.

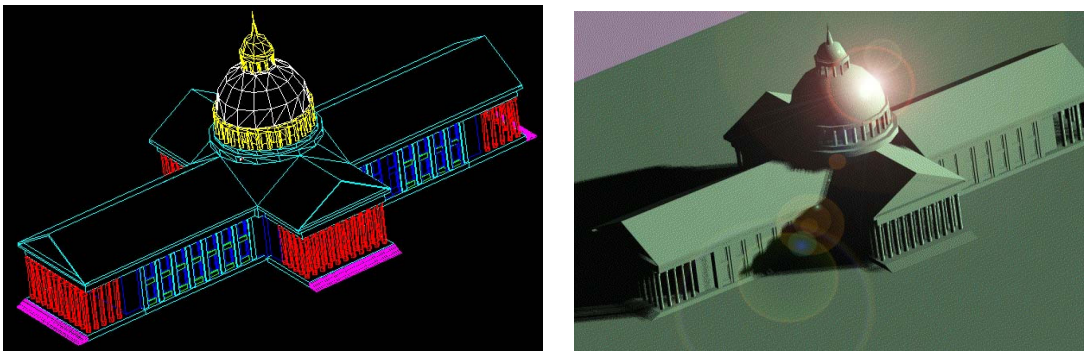


FIGURE 3: CAD 3-D model (by Ayman H. Mahmoud)

Figure 3 shows a typical CAD model, the left image shows the modelling process of the building and the right shows the rendered version, with texture and shading applied. Sipes (1994) has described the difficulties of such a process that depends on the information database, and the computer hardware configuration.

3-D GIS

Extruding the third dimension from the 2-D plan

Traditional CAD models are not based on any spatial data, and thus makes them inaccurate and limits their functionality to anything other than forward visualisation. CAD representations of cities reflect 'iconic' digital models in contrast to GIS where the focus is on more 'abstract' or aggregate' representations and simulations of urban structure and process. In this sense, GIS embodies tools more likely to inform passive simulation, experience and communication

(Plewe, 1997). *Geographic Information systems applications are powerful graphic toolboxes for the visualisation of spatial data integral to the work of urban planning and urban design* (Smith, Dodge & Doyle, 1998). It represents a variety of software packages that help the user collect, store, manipulate, view, and analyse information that can be geographically referenced.

GIS has traditionally been restricted to the realms of the two-dimension, though recently research has gone into developing the capabilities of GIS to handle three-dimensional visualization of the built environment data (Faust, 1995). This has often been achieved through the linkage of CAD technologies to a GIS database, one such city that has seen the merger of these two technologies is Los Angeles that will be discussed later in this paper.

The successful link between Computer Aided Design (CAD) and GIS spatial data has long been the quest for the planning world. *While visual simulation is proving to be a useful tool for viewing neighbourhoods as they currently exist or as they might appear after built intervention occurs, it can also be an effective interactive planning, design and evaluation tool when linked to GIS* (Liggett, friedman & Jepson, 1995). The merging of these two technologies will revolutionise urban design, *in the past, our understanding of cities has largely ignored the third dimension but with the existence of 3-D GIS, then a new world of relationships awaits* (Batty, 2000). When combined with computer simulations, GIS provides a powerful way for communities to explore and visualize possible scenarios for their community. *If a virtual city is to be more than just a glitzy visual presentation, it must be linked to intelligent data that contributes to its design and operation* (Sullivan, 2001).

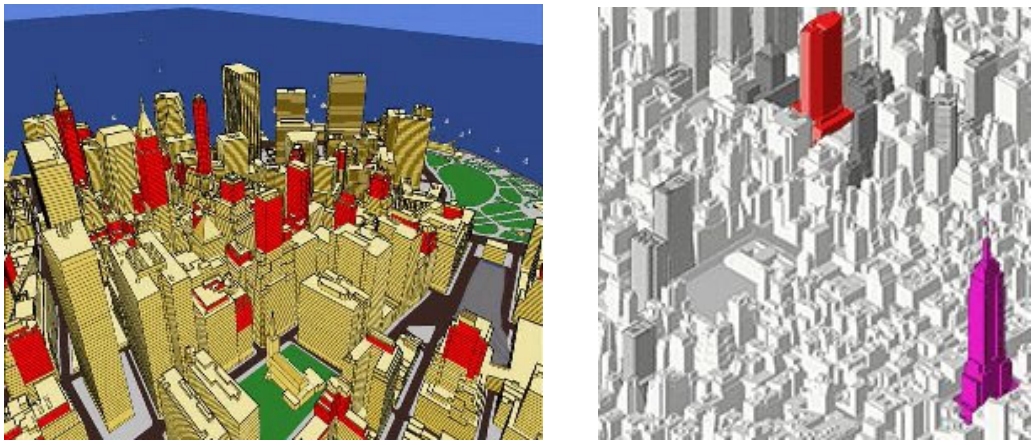


FIGURE 4: 3-D GIS used to show various renditions of building outlines in Manhattan

Figure 4 shows the use of 3-D GIS in various renditions of the Manhattan cityscape. Such examples are no more than visual extrusions of 2-D building outlines and as such, do not add much beyond the basic thematic map, other than imparting a sense of place and perhaps complexity through the third dimension. But this particular form of analysis does have *enormous promise* (Batty, 2000). There a number of models now emerging that extrude the

third dimension from the 2-D plan. *Figure 5* shows one such model of London, with the 3-D model extruded from the 2-D data on the left. The model shows the difficulty of using base data when modelling irregular shapes such as St' Paul's Cathedral which does not conform to the standard polygon form.

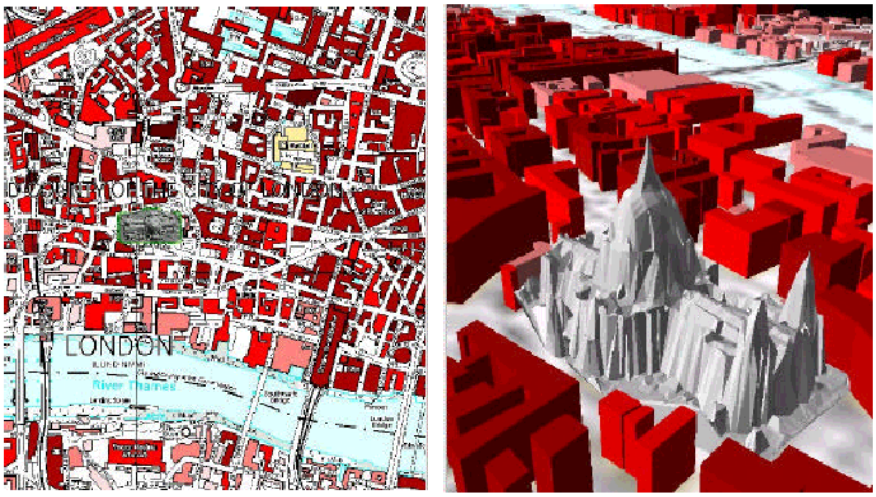


FIGURE 5: 3-D block modelling of St. Paul's Cathedral, London

There is currently no standard or predominant technology for 3-D GIS modelling of urban environments to date but with the advancement of IT and data manipulation technologies, costs of acquiring and maintaining such models are rapidly decreasing. The primary benefit of such 3-D models is in their persuasiveness and visual impact. Michael Kwartler of the Environmental Simulation Centre says, *the seamless integration of GIS with real-time 3-D interactive visualization, policy simulation, and impact analysis software will revolutionize community planning and design-decision making* (Kwartler, 2001). It is largely agreed that those 3-D models that were strongly coupled with or derived from a GIS were the models that were the most *information rich and were built to last* (CASA website)

VIRTUAL REALITY MODELS

Virtual solutions to real problems

Virtual Reality (VR) has received an enormous amount of publicity over the past few years. Potentials of VR applications have been realised in many disciplines. Virtual Reality Systems, with their increasing dynamic, interactive and experiential characteristics are able to simulate real environments with various degrees of realism. The term "virtual" has become ever more ambiguous. VR now embraces a variety of systems from the totally immersive, centralized, single user tools with which it began, to the entirely decentralized, remote and anonymous technologies spawned by the net. Into the milieu has come the 'city' metaphor which likens a virtual world or virtual reality to an urban complex, often represented in 2-D or 3-D form, as maps and scenes in which users explore and interact with the objects of their interest

VR models allow the user to explore every part of a model and thus *minimises the dangers and misconceptions of bird's eye view perspectives that scale models and computer generated images very often suffer from* (Bourdakis, 1997). Virtual Reality models that can be interactively explored will undoubtedly make the visual presentation of ideas and proposals at planning meetings or over the internet far more interesting and understandable for the public. For the process of forward visualization VR models of urban areas are and will over time revolutionize the public participation process.

Since its introduction, VR systems have been viewed as the ultimate solution to a whole range of problems from all walks of life. Advantages of virtual reality tools for urban planning, when used correctly can facilitate research and practice but according to Bourdakis, *care should be taken and thus further research is needed on the implications of its use in different stages of the negotiation/design process.* He sees the role of virtual reality is *not to imitate reality but to aid in communicating ideas, designs, teaching, etc. in situations where the real environment is unavailable, unreachable or generally inaccessible* (Bourdakis, 1997). Virtual Reality is considered one of the ultimate information visualization tools, yet, constraints such as accuracy, hardware limitations, display resolutions and cost still act as a barrier to the development of VR in urban planning.

USING URBAN SIMULATIONS IN THE PUBLIC PARTICIPATION PROCESS

Planning by consensus, not by injunction
(Kwartler, 2001)

Urban planners, as well as designers, investors, policy makers and concerned citizens have often demanded an innovative method for experiencing the built environment before it has actually been built. The search for such technology has been apparent since the early years of computers when methods of visualization were restricted to cardboard models and drawings. Since then planners have experimented with a number of techniques to present their ideas or decisions to the public. Traditional methods range from coloured maps and site plans, cardboard models, rich architectural rendering, photomontages, or a combination of these. *However none of these tools have served to be a complete, effective technique to convey the past, present, and future of a place to the wide array of diverse players in the planning process* (Jepson, 1999).

Through computer simulation technology planners can realistically present and successfully develop good design decisions that help create consensus among the many people involved, not only to aid the professional designer but also the community layperson. *More than the services of a well-trained designer or planner, a well-planned neighbourhood requires good translators and good teachers* (Jepson, 1999). In contrast, the planner may also produce a

bad design or indeed cause conflict rather than consensus with urban simulations. With the capabilities of urban simulation, planners and designers will be more effective in teaching the public the tools of design, translate a design solution to meet the felt needs of the community and empower them to engage in participatory design for building true consensus. *Within a generation, the singly largest use of 'new information technology' in planning will no longer be in an exclusively professional context such as in preparing development plans or in development control. It will be in educating the wider community in planning matters and in engaging the community through planning information and participation in the design process* (Smith, 2001).

With access to urban simulations, the Local Community could experience and visually understand the impact of a proposed development in an intuitive and interactive way. Thus, they are empowered into the design and decision-making process during a planning meeting (Chan, Jepson & Friedman, 1999). William Jepson who is seen as the father of urban simulations and is director of the Urban Simulation Laboratory at UCLA says, *Urban visualization is proving to be a valuable tool for designers and planners. The ability to visualize potential modifications to the urban fabric and experience these changes in their actual context allows planners and designers to evaluate alternatives rapidly, in more detail, and for lower cost than through more traditional analysis. It also makes the results of planning process visible, allowing the public to view the proposed changes to their environment in a realistic fashion* (Jepson, 2001).

Using urban simulations, the *pedestrian experience* (Levy, 1998) can be simulated and thus reviewed by members of the community during the early stages of the development process. Thus, such models can then save the developers money on projects that the public have deemed inappropriate before it has actually been constructed. Levy explains the importance of computer-aided design in the American planning system and sees its development as being paramount in the involving of communities into the design process. *By actually visualising possible development scenarios, communities have the means to evaluate potential action against vision. It is important to know if a proposed bylaw, with it's setbacks and heights for buildings, will place a public park in shade during the winter months, etc…* (Levy, 1998).

Narushiga Shiode of the CASA team at UCL comments on how the usefulness of simulations for public participation depends on the administrative system (as it differs from country to country) but in general is very useful, *urban simulations are a persuasive tool in general, as they provide visual information which is easier to understand for the wider public and those affected in the community; and it is being utilised more and more in the public sense* (Shiode, 2001). Another enthusiast of the capabilities of urban simulation systems is Ike Rosen, whose firm has created a three-dimensional model of the city of Philadelphia, *People can't read architectural drawings and they can't relate to models, but I realized they found virtual*

reality technology cool and that maybe I could relate to clients that way (New York Times, December 16, 1999). Henceforth, a selection of projects will be examined which highlight the extent to which urban simulations are improving the public's participation in the planning process

VIRTUAL DESIGN ARENAS / VENUE

The CASA team at the University College, London are currently developing a virtual world server on which they can host small three-dimensional design scenarios to aid amongst others, the general public in the planning process. The models creators, say *the ViDA initiative is an experimental initiative in using available multi-user world technologies in visual communication for planning and urban design* (Smith, Dodge & Doyle, 1998). They will develop specific virtual worlds in which various people can participate in and modify, e.g. changing building colours or textures, altering size and plot position, or removing buildings and objects to create completely new structures and layouts. At present the ViDA (Virtual Design Arenas) initiative is an experiment in urban design, but the creators are considering developing the project to include more elaborate scenarios with role play where different participants assume the role of the planner, the developer or the local resident. The creators are hoping the experiment will prove a success for the communication of ideas from the planner to the general public, *the communication between participants, particularly 'over the net', could well be improved beyond "chat" text messages using desktop video-conferencing and "whiteboard" technologies* (Smith, Dodge & Doyle, 1998).

WESTWOOD VILLAGE, LOS ANGELES

In 1996 the urban simulation team at UCLA were commissioned by a local developer to build a virtual database of a proposed mixed-use development, Westwood Village, in the heart of Los Angeles. The development consisted of high-rise apartments, a multi-theatre complex and a central plaza with three levels of high-end retail and restaurant space, seen below in *figure 6.*

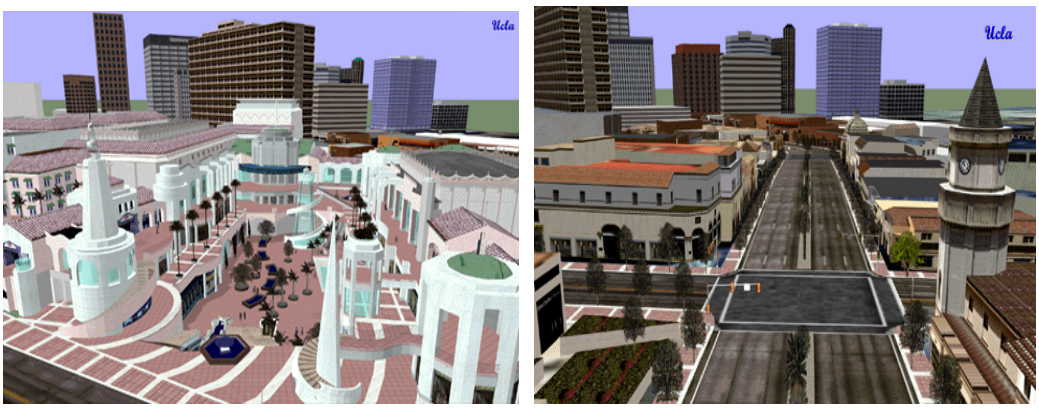


FIGURE 6: Westwood Village, Los Angeles

The resulting simulation database allowed the developer to study the physical impacts of the development plan from various angles to scale, allowing him to look out windows and modify buildings where windows were unexpectedly blocked. However, the most important use as an interactive visualization tool came when he presented the simulation at a community meeting. The local residents were able to experience the proposed development by flying, walking or driving to any location in the Westwood neighbourhood and then viewing the project from that angle. As a result of this consensus-building meeting the local community were able to give valuable input to the design and were also alleviated of certain fears they may have had.

William Jepson who headed the urban simulation team who created the model for Westwood Village is very optimistic about the future of simulation systems like that created by his team at UCLA. He said, *as demonstrated by the Westwood Village project, the Team's simulation system is extremely valuable at placing new development into the existing built environment so that it can be evaluated in it's actual urban context. This system allows the Urban simulation Team to include virtually everyone in the planning process, expert and layman alike. The Team has found that designers, architects, developers and consultants are able to identify real problems and remedy those problems long before the first hole on a new development is dug.*

VISAGE PROJECT

The VISAGE project has given planners the ability to unleash the full potential of their CAD models, without having to invest in expensive computing equipment. They can demonstrate to their community the impact of their building in life-like visualizations and animations. This project is a result of the combination of the Edinburgh Old Town Renewal Trust and the Edinburgh Parallel Computing Centre (EPCC). The system they have developed will allow people all over the world to explore a virtual Edinburgh, via a highly accurate and realistic computer simulation, shown below in *figure 7.*

FIGURE 7: Edinburgh model generated by VISAGE

The project has important practical implications for the future development and modernisation of the Planning system. The software lets you tour the tour the city, development areas and

visit controversial buildings that are yet to be built. The transference of computer effort to a central computing 'bureau' means photo-realistic images and video-sequences can be created on desktop PC based systems. This will be of great benefit to small or medium based planning offices who only carry out such work occasionally, making it uneconomical to provide dedicated equipment.

The project team say the benefits are clear: CAD models can come to life and be effectively used to assess the visual impact of new buildings and landscape developments. The visual appeal of the resulting 3-D animations helps architects to present and promote their ideas to a wide audience. The VISAGE project is a perfect example of how computers can be used to visually present the impact of architectural change to the public. VISAGE has already been used to assess the visual impact of the William Younger "Dynamic Earth" Exhibition Centre in Edinburgh before construction had even started, and has been used by the press to illustrate the location of the new Scottish Parliament building before any part of the building exists.

THE ENVIRONMENTAL SIMULATION CENTRE

The Environmental Simulation Centre (ESC) has been involved in the development of 3-D models of cities with the aim of viewing planned buildings in their context and hence improve the planning process by encouraging more discussion and public participation. The ESC modelling approach is principally used as a community planning support tool for site selection (locating proposed developments) and design review. Their models are interactive design tools to visualize developments and to bring the design review process to community groups in a bid to foster public participation in the planning process. The ESC sees their models as *an environment that people can instantly relate to and move around in.*

The Environmental Simulation Centre (ESC) have been heavily involved in developing various 2-D and 3-D GIS models for the city of New York. *Figure 8* shows one such model that was originally modelled to identify commercial floor space that had potential to be converted into apartments. Now the centre has turned it's expertise to creating models to *view planned buildings in context and hence improve the planning process, and they see their effort encouraging more discussion and public participation in planning and design* (Batty, 2000).

FIGURE 8: ESC's model of Manhattan

The centre, which is directed by Michael Kwartler, an urban designer with extensive experience in resolving planning-related citizen disputes, employs PC-based software that allows citizens to model various site-specific development. It accomplishes this by linking two and three-dimensional visual representations of places with databases and spreadsheets. Changes to the visual "environment" are instantly assessed in terms of impacts. Design issues can be explored in the model by moving urban elements and buildings of different designs, e.g. different objects can be dragged into the 3-D environment from a palette of typological elements. The software was initially created to help resolve community disputes, but is increasingly used to promote proactive community vision plans.

When citizens feel that they are *in charge* of the planning process–that growth is not simply something that is going to happen to them– they are much more willing to accept and even embrace change in their communities. Most importantly, it will provide a context in which a community can examine the implications of their day-to-day decisions. Michael Kwartler has also built a three-dimensional model of a SoHo neighbourhood for a developer seeking to build a hotel there. He explains how the model was extremely useful in engaging the public into the process, *we showed the model to the community, let them fly around it and look at things from different angles and we sailed through the public hearing. After all, it's much easier to do urban planning by consensus than by injunction (Kwartler, 2001)*

VIRTUAL CITIES

Shaping Cities: Pixels to Bricks
(New York Times, December 16, 1999)

There are now a large number of cities across the world which have had 3-D virtual models constructed and made available over the internet using VRML technology. In March 2000 CASA (the Centre for Advanced Spatial Analysis) was commissioned by the Corporation of London to undertake a comprehensive review of the current 3-D models of cities. Eight models were researched in depth out of the sixty reviewed overall. The models ranged from CAD models through various 3-D GIS to VRML Web content and related simulations.

The survey undertaken by the team found that of the sixty or so models for large cites, very few actually offered anything other than visual interest, *often designed simply to show that this kind of virtuality is possible, or for 'infotainment* (Batty, 2000). The research concluded that the true use of these virtual city models was in *communicating designs to non-expert*

*audiences whose abilities to appreciate urban change and urban form through immediate visual imagery will always be the main focus of these virtual city models (*Batty, 2000)

The development of realistic 3-D models of the urban built form is vital to the concept of a 'virtual city'. Here three examples of virtual cities will be studied, the development of 3-D models for London and Bath in the United Kingdom and Los Angeles in the USA. The models will be assessed as to their effectiveness in improving public participation in the planning process.

LONDON

A number of models of the City of London have been developed with the intention of informing and communicating ideas to the community. There have been a number of attempts to model the City of London, by various parties, yet none have been able to comprehensively map the whole city and most have been produced purely for community groups, political and related decision makers and for the tourism industry. Prof. Michael Batty, of CASA, explains how none of these models have the *sophistication and functionality* of the New York and Los Angeles models but for the purpose of this paper these models are important for the process of a term coined by himself – forward visualisation.

One such model created to for this purpose has been created by the CASA team at the University of Bath, headed by Prof. Alan Day. The team have also been involved in the modelling of the City of Bath which has been seen earlier on in this paper. They have put their expertise towards the production of a 3-D 'fly-through' map (*figure 9)* of the Soho area of London with the purpose of a public information tool. The entire area is modelled in 3-D with each building's form accurately represented. As well as showing what happens above ground, underground features are included. It is possible to make links between objects in the model and data held on the Internet using the World Wide Web. The "Map of the Future" is promoted as a *tool for analysing the relationships between built form and various kinds of data. In the future they will offer a publicly accessible interface to a wide range of urban information*.

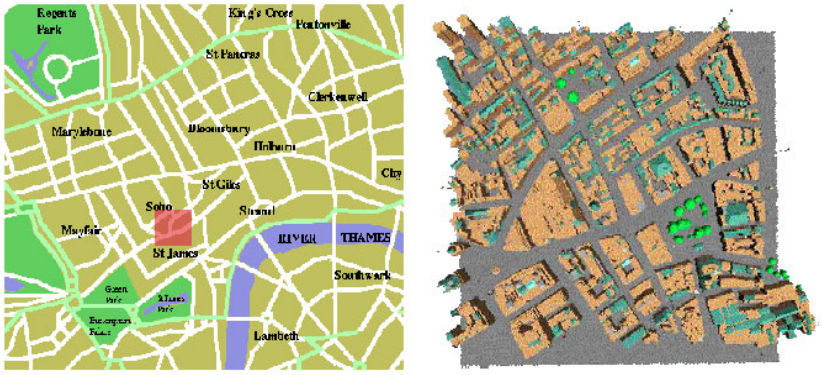


FIGURE 9: The University of Bath's "Map of The Future" for Soho, London

However the most ambitious attempts at modelling London is happening at the Centre for Advanced Spatial Analysis at the University College, London The expert team are attempting to lead the world of urban simulations with the construction of a 3-D virtual model of London. This model will be a visualisation of all buildings within inner London through which users can navigate at street level as well as fly across in panoramic fashion. Virtual London, as seen in *figure 10,* will involve highly advanced spatial data and database technology and will be made available over the internet. As well as walking through the model users will be able to fly over inner London buildings in panoramic fashion. Via their desktop computers, members of the public will be able point and click on any building or street to reveal data concerning floor space, land use, rents, traffic volume, etc. Users will be able to make proposals and seek answers to 'what if?' questions involving placement and visualization of new buildings, demolitions and changes to transport links.

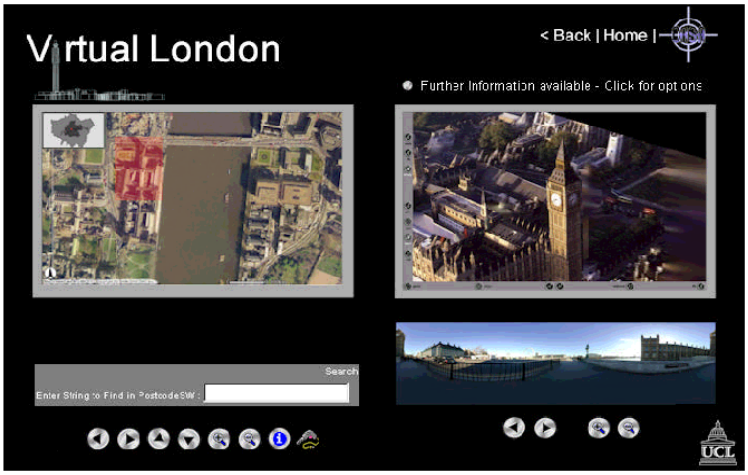


FIGURE 10: Virtual London; an effective means of public participation

CITY OF BATH

A model with a true public participation role is the Bath model. In 1991 the Centre for Advanced Studies in Architecture team at the University of Bath was given a grant by Bath City Council to construct a 3-D computer model of their historic city centre. The model is extremely important, as it is the most comprehensive of its type available in the UK and a very good example of the use of VRML to produce virtual models of cities. City planners have used the model to test the visual impact of a number of proposed developments for the city's future (*figure 12*). The model was constructed from aerial photographs using photogrammetry and is accurate to less than half a metre and covers the whole city centre, (Bourdakis, 1997). *Figure 11* shows the Bath model converted into VRML.

FIGURE 11: Bath model in VRML

The Bath model is being used in a to widen the public debate on how the city should develop in the future but also has a variety of other uses, most notably development control. This has been achieved by providing the model over the internet and showing a number of proposals for the city's future. *Figure 12* shows two screenshots from the model showing different proposals for new development. The public can then provide relevant feedback on proposals; this concept of a 'digital democracy' will be explained and evaluated in section 9 using a number of similar models being used as a voting system. The creator of the model Alan Day of the University of Bath says, *there is a lack of consistency on the levels of detail employed by planning authorities in presenting and documenting their policies and strategies to both professionals and the public. There is clearly a series of communication problems in this field and it has been advocated that computers can offer satisfactory solutions* (Day, 2000).

Vassilus Bourdakis who was one of team behind the model explains the benefits of computer visualizations in the public participation process, *it vital that any planning process should leave space for discussions between the planners and both local authorities and the public. An important issue for facilitating this communication process is to promote data presentation that is informative, accessible and able to successfully present complex interactions, phenomena and underlying expert analyses to professionals as well as lay people* (Bourdakis, 2001).

FIGURE 12: Bath model showing proposed new development

LOS ANGELES

An urban simulation team headed by William Jepson at UCLA is in the process of creating a virtual model of the entire Los Angeles Basin, which comprises roughly 4,000 square miles in order to help solve a multitude of urban design and planning related problems in the city. The team have created a system which according to Jepson is an *extremely effective tool for interactive design and consensus building in the intricate process of city planning* due to the simulation's *interactivity, intuitiveness, flexibility, photo-realism and adaptability* (Jepson, 1999).

The team have developed the UST Urban Simulator that has been designed to respond to the unique requirements of urban planning and design. The simulator draws on technology already familiar to the world of visual simulation and virtual reality to create a system specifically designed for efficiently modelling and simulating urban environments, both existing and proposed. In projects such as the Los Angeles Basin virtual model simple 3-D models are combined with aerial photographs and street level video to create a realistic urban neighbourhood. The LA model (*figure 13*) can be interactively explored by the public by either flying or walking through the virtual world, enabling the user the closest inspection of any proposed new development. Although one of the most impressive examples of urban simulations in the world, the model's functionality as a public participation is severely limited for it's lack of accessibility as its sheer size making it impossible for internet usage as yet.

FIGURE 13: Downtown Los Angeles

USING THE WORLD WIDE WEB FOR PUBLIC PARTICIPATION

Planning on the information superhighway

Years ago, before the information revolution the public had to make do with the limited information available to them. Before the internet boom, information was a closely held commodity, now that has all changed. *The potential of visualization in the planning and design of the built environment on the computer desktop and over the internet offers potential*

to enhance the planning and design process; and also help communicate ideas and developments to the public at large (Dodge, Smith & Doyle, 1997).

For urban models to be of any use in encouraging the public to become involved in the process then they have to be made truly accessible to all. This is where the importance of the internet comes in as the ultimate communication tool. The World Wide Web has been hailed as a revolutionary medium, opening up new forms of computer-mediated communications, allowing for new forms of information dissemination, social interaction and collaborative working. When regarding the issue of public participation in the planning process the role of the internet can never be overlooked, *GIS and other related technologies through public participation can be seen as a precursor to the role the World Wide Web could take as a distribution mechanism, not only within planning but within any process where consultation may be required* (Doyle, Dodge & Smith, 1998).

The development of urban models on the internet has until recently been restricted by limited software, *CAD and 3-D on the net has not moved as fast as expected due to a combination of cumbersome, non-intuitive interfaces and lack of killer applications* (Leavitt, 1999). The majority of urban models are now distributed over the internet using VRML (the Virtual Reality Modelling Language), a geometric modelling language that allows users to define geometric objects as well as all sorts of rendering and animation elements. The language provides the basis for the majority of existing urban models on the World Wide Web, such as the city of Bath model shown in *figure 14.* VRML provides a flexible, cross platform environment to model the urban form, the user is able to freely explore a model and view details from any angle, providing a very flexible way of interpreting any given model using a suitable browser.

FIGURE 14: The city of Bath model in VRML

The CASA team at UCL have been experimenting with a link between GIS and Virtual reality Modelling Language to provide tools to undertake the sketch visualisation on the planners desktop. *Such an interface, coupled with the accessibility of the WWW, has the possibility of opening up a new concept of urban design and public participation* (Dodge, Smith & Doyle 1997). An example of a VRML model created by the CASA team is shown in *figure 15.* The user is able to move any aspect of the model independently of each other giving them the ability to create their own interpretation of any given design scenario. Two of the models creators said, *as these powerful software visualization tools become widely available on the*

WWW the potential exists to undertake networked urban planning and design, which may be particularly applicable to widening public consultation and participation projects (Smith & Dodge, 1997).

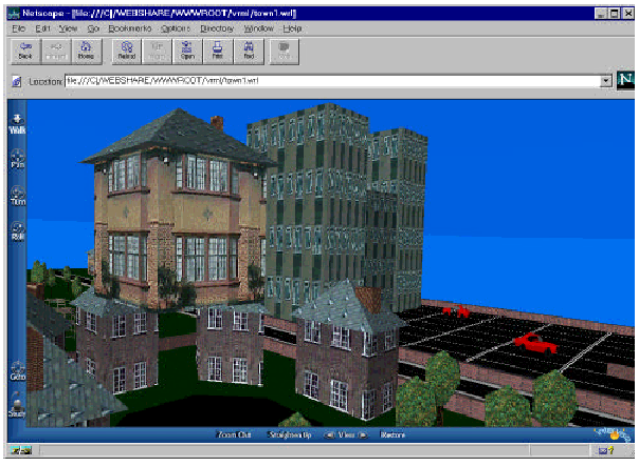


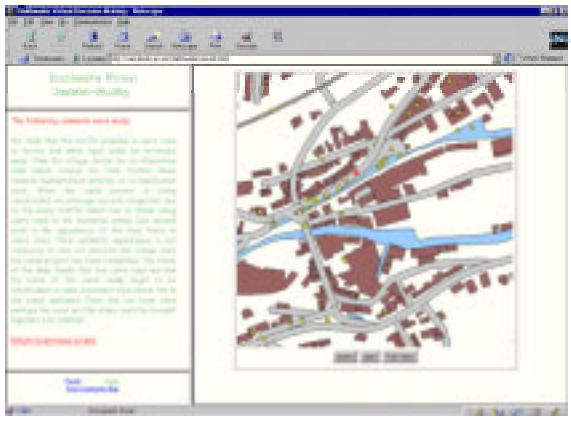
FIGURE 15: VRML 2.0 interactive model

There is immense potential for improving the public's participation in the planning process by using the world wide web. Traditional methods of public participation at planning meetings quite often involve a confrontational atmosphere. This can discourage participation by an often less vocal majority causing public meetings to be dominated by individuals who may have extreme views which may not necessarily represent the wider view of local people. Planning meetings often tend to take place in evenings at specific times which can limit the numbers of people who are able to attend. The restricted time and also the actual geographical location of public meetings can further restrict the possibility of widespread attendance. Physical access to such meetings can also cause problems for the disabled, the elderly and infirm as well as those who maybe deaf.

There are many advantages to a web based approach at local, regional and national public participation events. The meetings are neither restricted by geographical location or time. Accesses to the information about the issues being discussed are available from any location with web access. The information is also available at any time of the day thus avoiding the problems associated with holding meetings only in evenings, opening up opportunities for more people to participate in public consultations. Essentially with a web-based system the public are at the end of a telephone line that enables them to make comments and express their views in a relatively anonymous and non-confrontational manner. This compares with the traditional method of standing-up in front of a group of relative strangers.

A good example of the success of using the internet to facilitate better public participation is the Virtual Slaithwaite project. In June 1998 the West Yorkshire Village of Slaithwaite carried out a *'Planning For Real'* exercise to identify the views and opinions of local residents regarding the environment in which they lived and how they would like their village to develop in the future. The Virtual Slaithwaite system is an on-line GIS facility and was arguably among

the first such system available to the public which allowed a two-way flow of information The project, which can be seen in *figure 16* showed the ease with which the people of Slaithwaite seemed to grasp the concept of using the World Wide Web which appeared to go against some of the work done by others in the past on public interpretation of maps. The ability to provide feedback and read other peoples' comments could potentially be used for conflict resolution or on-line debate and discussion about particular issues



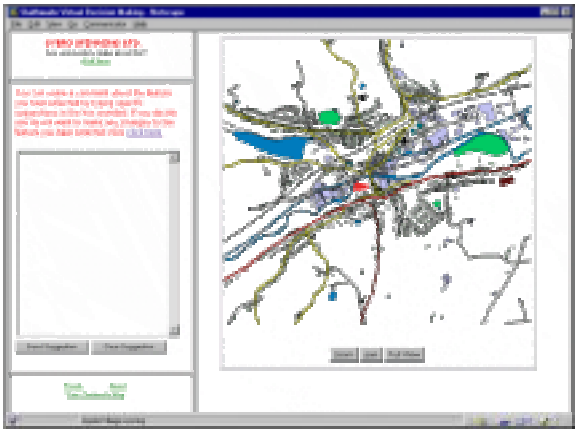


FIGURE16: Virtual Slaithwaite

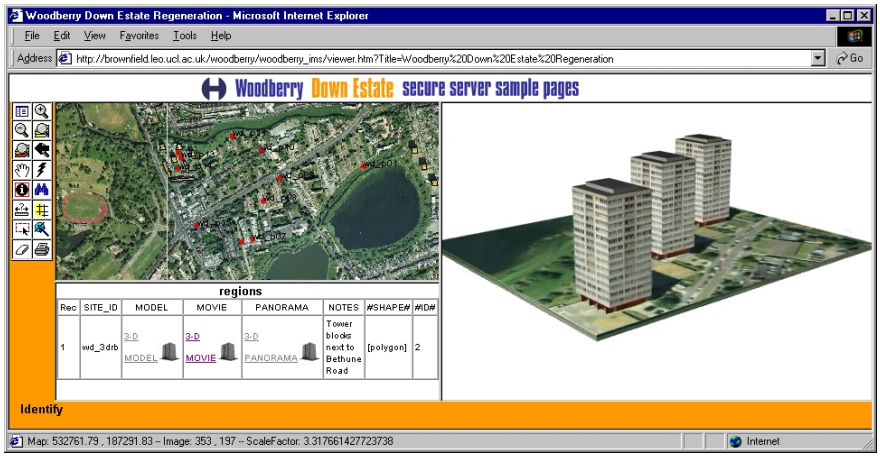
DIGITAL DEMOCRACY

The now widespread use of the internet has spawned a new area of planning, that of digital democracy. 'Digital democracy' has become the new term coined to explain the use of new technologies such as the internet in the modern political system to spawn a wider range of voters. Virtual simulations are beginning to play their part in this emerging process, as they are increasingly being used is as a voting system to gage the opinions of the public on various schemes or developments. The widening public use of the Web means that it could

be used to bring a higher degree of democracy to government and the planning system. The technology gives every person with access to an internet connection the ability to provide information, and to access information themselves that may help them make informed decisions. The technology also allows those interested in the public's decisions the ability to collect this information from a wide spread population and provide feedback. As already explained, the use of virtual simulations, available over the internet has brought more people into the process which before was dominated by public meetings which were generally unproductive and did not provide a true representation of the public's view. A number of projects will be reviewed which have used virtual simulations in such manner to increase the number of people involved in the decision making process.

WOODBERRY DOWN, HACKNEY

Andy Hudson-Smith who is a member of the CASA team at the University College, London, has been involved with a project in Woodberry Down, Hackney. The project is aiming to increase the community's involvement in the council's regeneration schemes by giving free computers and internet access to thirty key residents. This is linked in with the area's regeneration plans and is built around a website which integrates 3-D Models, GIS, general information and a bulletin board where residents can post their views on the proposed plans. *The process of engagement is designed to be fully interactive, with residents not only being able to see information about their area concerning their current and proposed environments, but more importantly being able to communicate their views and proposals to the Regeneration Team and to other residents* (Smith, 2001). The benefits of the scheme are numerous as through a method of simple forward planning the community are worked with and involved at every stage, thus greatly reducing the chance of objections at the later crucial stages of development. The model's creator said, when interviewed, *our models are aimed at providing a true view of a development, rather than an architecturally rendered view which is a mere marking tool* (Smith, 2001).



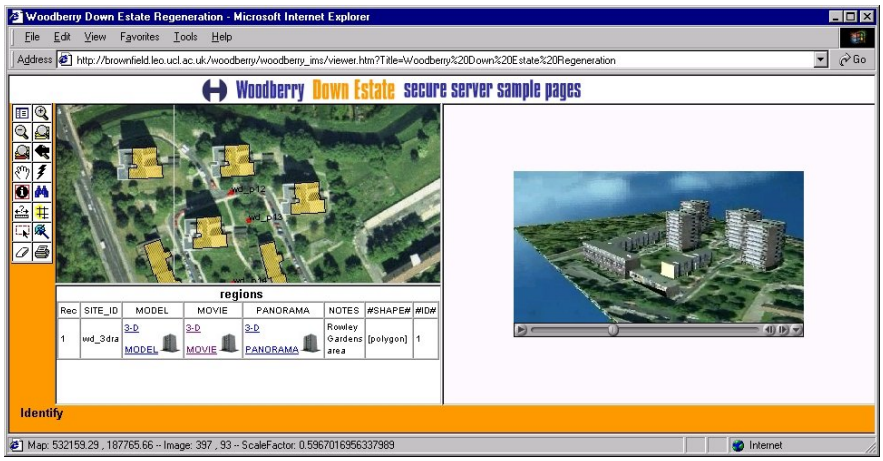


FIGURE 17: Two screenshots from the Woodberry Down Project website

The scheme seen in *figure 17* has been nominated for a RTPI National Award for Achievement and has been hailed by a large number of people, including residents of the Hackney area, Andy is particularly enthusiastic about the projects achievements, *the great success of the venture was in the synergy created between complementary views of the local environment and the way users of the Exploratory could generate different ideas through the range of material and digital media available* (Smith, 2001). He is especially optimistic about the future of digital technologies for facilitating better public participation, he sees the project as *a wonderful example of how digital technologies can enable a disenfranchised community to realise its own future* (Smith, 2001)

CAMBRIDGE FUTURES

Cambridge Futures, led by Prof. Echenique's group is a non-profit making organisation consisting of local business leaders, politicians and academics. They have been looking at the options for growth in and around Cambridge and aim to explore what kind of environment people want to create over the next 50 years. The group has utilised the use of urban models and the internet to display the seven alternatives to the public. The community then votes for the option they feel will best benefit themselves and Cambridge's future. The models used in displaying the alternatives, such as new transport links or decentralisation were then used as a basis for public hearing, *figure 18* shows a proposed option termed 'green swamp'. The models have been created to illustrate the proposal for mixed-use development on the site of Cambridge Airport. The model on the right shows how the area will look if this proposal was given the go-ahead

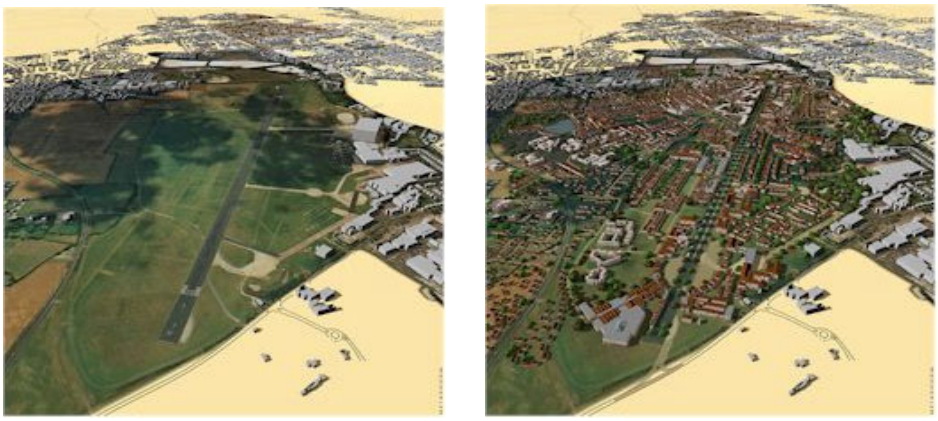


FIGURE 18: 3-D Model showing a development proposal for the future of Cambridge

IJBURG, HOLLAND

The Dutch have demonstrated a rather more ambitious form of public participation. On March 1997, inhabitants of Amsterdam voted on the construction of IJburg, a proposed development in the IJmeer on Amsterdam's east side, see *figure 19.* A three-dimensional representation of the development was modelled in VRML and broadcasted on Dutch television several times a week before the referendum. People watching the broadcast were allowed to interact by navigating the model using their telephone keypad, which was seen by all others watching. At the end of their journey the viewers would be able to see how that particular person voted – a green sphere if they wanted the development to go ahead and a red sphere would appear if they disliked the project. Even cleverer than this, the visitor could voice their opinions on any particular part of the proposed development which was recorded and could be listened to by any following visitor who when passing your 'sphere' could here why you voted as you did. The Dutch who are renowned for their intuitive thinking have truly lead the way in the development of a truly interactive virtual environment for urban planning. Although the use of the telephone seems a rather primitive form of technology the IJburg will undoubtedly lead to further similar projects.

FIGURE 19: New development in Ijburg, Holland

DRAWBACKS OF USING URBAN SIMULATIONS FOR PUBLIC PARTICIPATION

Despite all the benefits of using urban simulations in urban planning there are also a number of problems that may hamper their development or limit their functionality. One potential problem of urban simulations is that the models are virtual models of reality and thus are not a true representation of urban environments. This therefore means the accuracy of the model is purely at the discretion of its creator and inevitably can be manipulated for their gain. This point is extremely important when involving the public who will not have the expertise to know whether the images they have been presented with are accurate. Narushige Shiode who is involved in making 3-D models, admits that this can be a problem within her profession, *the potential problem is that we can cheat on simulations and that they can send out a false message. In fact, we can easily create a simulation that points to a preferable option, without making it explicit* (Shiode, 2001).

Micheal Kwartler has received some criticism for the work he has done. He explains how urban simulations can make things look nice that are in real life blights on the landscape due to the limited power of most models, meaning they cannot show every gritty detail. This reaction is put down to people's high expectations of modern technology. Kwartler has also come under attack from architects and developers who feel threatened by computer simulations which levels the playing field allowing the client to visualize just as well as an architect, thus not having the same level of control over the public they are used to. He says, *normally, an architect goes to a meeting with three drawings – each of them a very manipulative view that's favourable to the developer* (Kwartler, 2001). Alan Day's team at the University of Bath is often commissioned to create renderings or animations for use in public exhibitions, etc. He has experienced such conflict between themselves and the designers. He says, *There is always a conflict between what the designers want to show and our more objective version of what is possible* (Day, 2001).

This criticism is also mentioned by Bourdakis who sees virtual reality simulations as a way of avoiding the tricks played by architects to reinstall the trust between the public and the professional in charge. He says *architects have a reputation for submitting non-realistic perspectives, omitting parts of schemes that are not fully designed and even hiding areas of schemes behind carefully placed trees or other features. Such communication deficiencies can subsequently lead to unsatisfactory buildings and heated post construction debates* (Bourdakis, 1997). He personally sees the future in virtual reality where viewers can explore every part of a scheme rather than being restricted to particular view or angle.

The problem has been illustrated in a case in Portland, USA when the planners involved created a demo model based on macro-scale traffic analysis. The team involved used this model to prove that their development proposal would not affect the neighbourhood. This model was used to manipulate the local public group, but unfortunately for them the group was headed by a transport specialist from the University of Washington. He disagreed with them and successfully proved the result would be totally different if shown using a local micro-scale model.

Bill Miller specialises in the production of 3-D city models that go far beyond merely the visual aspect and his models are used to recreate a whole range of scenarios. He criticises the use of visual simulations, *visual simulations by themselves are very misleading because they only show the surface of things. Visual simulations should be part of a much larger and more dominant set of behaviour simulations. How it looks doesn't mean anything compared to how it works* (Miller, 2001).

A problem that has been experienced in America is peoples' high expectations of planners and their use of IT. At present most citizens and community leaders will expect little more than access to 2-D maps and plans. With numerous cases appearing it may soon become the case that all local authorities are expected to declare all information over the internet and all produce highly detailed computer models. At present this is obviously a task way out of the financial and technical reaches of most local authorities in the US. However this is not seen to be the case in Britain as yet.

Chicago's Pilsen neighbourhood is a useful example highlighting some of the drawbacks associated with using computers in the public participation process. The computer system introduced was a *means for residents to visualize past, present and future neighbourhood conditions, enabling them to have a greater voice in the design of their neighbourhood* (Al-Kodmany, 1998). The GIS system implemented was successful in many ways including the promotion of trust and development of meaningful public participation but it is also encountered problems that will be drawn upon here.

Firstly, during public meetings a single image often revealed a number of both positive and negative issues instantaneously. As images were displayed, new issues were constantly brought to light. Kheir Al-Kodmany says, *as a consequence, it was often difficult to focus the discussion on one issue from start to finish, as new issues were constantly displayed on screen* (Al-Kodmany, 1998). The team who presented these community meetings also incurred serious difficulties in the use of the technology they needed for their simulations. Although sounding trivial, the actual transportation of the large amounts of technology needed proved to be a burden and resulted in a number of glitches during the process. As well as these frequent glitches, the computer was often slow in processing information such as

loading images and overlaying thematic layers. *These delays often prolonged the planning process and interrupted the constant flow of ideas* (Al-Kodmany, 1998).

The overcoming of this problem is a necessary improvement if the technique is to be successfully used at public meetings. Michael Shiffer who is Director of the urban Data Visualization program at the University of Chicago says although 3-D models give the *public a chance to envisage implications of the different development paths that they may choose…however for 3-D to work in this context however, it needs to perform rapidly and flawlessly (sadly, this is still a tall order)* (Shiffer, 2001). Alan Day, who has created a three dimensional model of the city of Bath was also hampered by the limited technology available at present, a*t the moment the technology is not powerful enough to allow fully interactive access to large models and that is a major disadvantage. Ideally you want to be able to edit the model in real time rather than just viewing it, but that takes a low of power if the model is large* (Day, 2001)

The main problem that proved to be most serious for the Pilsen neighbourhood team was the substantial costs of developing the GIS system. The team well exceeded their budget for the project due to the labour intensive activities required in gathering and assembling the images, maps and historical data. However they did say *the benefits of this system for the University and the neighbourhood far outweighed the cost*. Alan Day has also mentioned how his team are limited by cost of new technology and says it is only really justified on major projects.

Despite the number of problems experienced by the developers, Al-Kodmany explains the project was a success; *Visualization is a key in public participation because it is the only common language to which all participants can relate. Visualization provides a focus for a community's discussion of their design ideas; it guides them through the design process; it raises their design awareness, and facilitates better communication* (Al-Kodmany, 1998).

CONCLUSION

Throughout this paper a large number of people have been interviewed to gage the general opinions of those involved in the use and production of urban simulations. It is clear that a number of planners, but most notably architects are feeling threatened by this new evolving technology, a view contrasted by the enthusiast and optimistic views of those involved with developing these models. The fact that these models have proven to involve the public far more within the planning process than ever before may hold the key to this fear. Are planners worried that their dominatory role over communities is being diminished and are thus not pursuing the development of this technology enough?

A certain aspect of fear is encountered in work carried out by Bourdakis, are *we close to giving too much control to the public in deciding about the future of the built environment? Does this mean that the urban planning is heading towards a 5th Century BC Athenian democracy scenario where every citizen had the right to comment and vote? Is it something needed and indeed wanted? What will the role of architects and planners be in the future? Are they going to be needed, or will the cities of the future be decided on phone voting sessions based on an series of interactive TV programmes where the public will vote for the facade, type of windows or roof shape of their new town hall? It all is an issue of balance of opinions as well as socio-political decision making* (Bourdakis, 1997).

A rather complex analogue provided by Ruth Bramson explains the importance of digital technologies for the improvement of public involvement, computer *assisted communication technologies are tools – like hoes or shovels, which are only of value when they are in service to the garden. If our communities are to benefit from new technology tools for civic engagement, we must be sure that our technology does not drive or overwhelm the participation process (you may not need a tractor in the backyard)* (Bramson, 2000). We can use a range of words and metaphors to explain the use of new technology to aid visualisation but the fact is simple: computer aided visualization leads to better understanding by the laymen which leads to better communication and collaboration between the planner and the public. Bramson explains that we should not become overwhelmed by this new technology and should not detach ourselves from its true use of facilitating better understanding by the public. Daniel Howard, a town planner highlights the importance of participation rather than advanced technology, he says, *participation is the key and the technology we use should be focused upon encouraging participation and not the technology itself* (Howard, 2001).

The use of urban simulations as a way of presenting ideas to the laymen that can be explored, changed and questioned can only be of maximum use when accessible by all members of society. Therefore the importance of the internet as a distributive tool for these models is great. The internet opens up the world of planning to the public, an area that has always been in the shade, especially during initial stages of the planning process. With the World Wide Web the public have the ability to be involved throughout a development's progression from the plans to construction, thus avoiding conflict at a later stage. Urban models that can be manipulated and explored are an exciting way of attracting people to look at these websites and provide feedback of their views.

This paper has proved the importance of visual simulation as a method of engaging a wider range of people into the planning process. It is the author's view that the public's involvement in planning is tantamount to better planning and the use of computer simulations is an extremely effective method of increase the public's participation in planning. The planning profession has unfortunately gained itself a reputation of being un-trustworthy and outdated. The use of computer simulations at planning meetings, exhibitions, over the internet, etc will undoubtedly go a long way in improving this unfair reputation.

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