Building Virtual Worlds: A City Planning Perspective

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Computing, networking and virtual reality technologies are gradually approaching the level of maturity where large scale multi-user virtual environments will be possible. This will inevitably lead to the development of large scale spaces for the on-line community to meet, socialise and carry out business. We might consider these environments to be virtual towns or, eventually, virtual cities which contain many of the features, and problems of their real world counterparts. This paper draws on literature from the disciplines city planning and architecture to raise some of the issues which may be important in the design, development and administration of these environments in order to make them pleasant, usable and manageable.

Keywords: collaborative virtual environments, city planning, on-line communities.

1. Introduction

The relentless expansion of computing technology into our workplaces and homes in the past 15-20 years is plain to see and widely acknowledged. What distinguishes the growth of the past 2-3 years is the uptake of networking technology which has been prompted largely by the development and popularity of the World Wide Web, allowing companies and individuals to create multimedia presentations of information and make them available to a potentially world wide market. In addition the advantages of e-mail and electronic file

transfer are becoming more widely accepted leading both to wider connection to the internet and the application of internet technologies in private company ‘intranets.’
The obvious result of these technological advances is a large number of people using powerful computers which are connected to world wide networks. One aspect of this networking is that it provides the possibility of communication with large numbers of people with similar interests. This has already been seen in the use of USENET News and similar systems which were first utilised by the academic community, where the networking facilities were widely available some years ago, and which are now more widely available due to the expansion internet access.
However, systems such as News are limited in that they are asynchronous. Further developments have allowed for real time text communication and even limited video conferencing. The most recent developments have established multi-user three dimensional environments, or Collaborative Virtual Environments (CVEs,) which allow a number of people to interact with others in a simulated 3D space. However, most current CVEs are limited to relatively small numbers of users and usually do not support audio communication, resorting instead to separate text based conferencing.
Looking to the future, we can anticipate that computing and networking power will continue to increase, and that this will allow CVEs to mature until it is possible to have large numbers of users inhabiting distributed virtual environments and interacting with each other using voice communication and other means such as gesture and possibly even facial and bodily expressions. One issue then is the development of the virtual environments systems to facilitate this and so we must consider areas such as computer graphics, interface technologies user embodiment and networking. However, alongside this there is the matter of the design of the environment where the interaction takes place. Given that we envision a large number of users, the environment must cater for their needs by first providing enough space but also considering what they need from that space, whether they are using the environment for business or leisure. In this way the virtual space can be considered to be a virtual town or city in that it has a number of inhabitants who may want their own ‘real’ estate as the base for their use of the space but who also want to engage in social or business activities in more appropriate, often shared, areas. So to look at the design of such spaces we can look at the way cities are designed in the real world through the literature of city planning.
This paper will continue by looking briefly at the parallels and differences between virtual and real cities. Section 3 will look at city planning on the large scale and section 4 at smaller scale issues. Section 5 will detail some considerations for the government and management of virtual cities in design and operation.

2. Real and Virtual Cities

Designers of virtual cities will have an opportunity that rarely arises in city planning - to build their space from scratch. This provides an opportunity to extract the best from a variety of city planning theories and apply it to the design of virtual cities. To do this well it is important to recognise the similarities and differences between the ‘real’ and ‘virtual’ branches of city design.
The main concern of city planners in both cases is to produce and manage a large and complex environment so that in some sense it ‘works’ for its large number of inhabitants. By this we mean that it provides the facilities that those users require for the activities they choose to participate in, whether alone or as a group. The inhabitants should be able to access these facilities easily and doing so should be a pleasant experience. This means that

users should be able to have a private space which they can make their own, which implies that some customisation of the environment should be possible, and also that this should be managed so as not to infringe on the needs of other inhabitants. The city should also support multi-user areas for work and leisure. Examples of these might be parks, office buildings, theatres, conference facilities and sports stadiums. To allow access to these facilities the city should provide an efficient transportation infrastructure.
In reality designing a city environment is a complex task of balancing these requirements and the possibly competing needs of elements such as industry, retail, business, residence, transport and leisure. The virtual city does not have to adhere to the physical constraints of the real world and so may be able to overcome some of the complexities of city design. Also, many of the physical artefacts which exist in a real city will either not be required or will not be an issue in the virtual world. For example, the issue of pollution from any 'industry' which exists in a virtual world will exist so it will not be a requirement that it is sited away from residential areas. It is not necessary to worry about issues such as parking, as cars will either not exist or will be available on demand. However, one concern must be how far we can stretch away from the metaphor of the city in designing our virtual environment and still have a usable space. As an example, it will not be necessary in a virtual world to produce a city on a plane, as is essentially the case in reality, but before we do we must ask if the users will be able to effectively navigate and maintain orientation in a highly three dimensional space. This problem has already been highlighted with respect to information visualisation (Chalmers, 1993) and could equally be an issue for virtual cities.

3. Large Scale Design

We can look at the design of virtual cities on two levels: large scale design which deals with the overall layout of the space, the positioning and proportions of different areas and the smaller scale design issues deal with the look and content of different areas, architecture, and provision of facilities for the inhabitants.
The first concern when designing the virtual city on a large scale is the structure which is to be given to the environment. Here it is necessary to consider the variety of different functional areas which will be demanded by the inhabitants, and therefore the range of activities in which those inhabitants will wish to engage. Many of these have been mentioned above, but to recap some of the most obvious, we might consider: meeting other people for social discussion or business meetings, which may each require a different functionality for the facilities they provide; recreational uses of the space such as viewing performances and 'sports,' or simply walking through pleasant environments as we would in a park (providing great potential for artistic design within the virtual world on a scale which would be impossible in the real world;) retail, as with the WWW it will be possible to produce displays of products using images and graphics and even provide on-line ordering facilities; and industry, where other businesses may provide contact facilities within the city - this may be include those providing services for the users of the space such as space design for personal or business areas. City planning over many years has developed a variety of approaches to the problem of producing effective layouts for cities. We will describe two contrasting theories and then try to define an approach which may be suitable for virtual environments.
The Swiss architect Charles-Edouard Jeanneret, who adopted the pseudonym Le Corbusier, developed a theory of city planning in the 1920's which has been very influential throughout the remainder of the century. The most striking element of Le Corbusier's approach is its strict adherence to geometric form, regularity and standardisation. In his

description of “a contemporary city of three million inhabitants” (LeCorbusier, 1929) he states:

> The city of to-day is a dying thing because it is not geometrical…The result of a true geometrical lay-out is *repetition*, The result of repetition is a *standard*, the perfect form. (original emphasis)

The result of this vision, a proposal for a large scale redevelopment of a large area of Paris, is a city based on a strict grid pattern with cells containing his (in)famous “skyscrapers in the park,” large high-rise developments within areas of open space, creating a high population density in the centre of the city. At the very core of the space is the main station which is sited at the intersection of main North-South and East-West roads and is the centre of the urban and national rail links as well as the focal point for “aero-taxis.” The road system itself is segregated depending on the type of traffic, with freight running underground.

Perhaps, for us, the most important point from Le Corbusier’s design is the way that the rest of the city is layed out. Each element in the city has a defined location: the huge central station surrounded but huge skyscrapers for business, whose lower floors house restaurants, theatres and similar establishments; an area for municipal buildings, universities and museums; the park, which may be ‘eaten into’ by the city if necessary; on the other side of the city is the industrial quarter, near to the main road artery; residential quarters contain blocks of flats; and the whole city is surrounded by a “protected zone” separating it from the suburban garden cities. The main point to emphasise is that everything has its place and is strictly segregated. Le Corbusier states that unless we replace our current (for the time) haphazard arrangements “*there is no salvation*.”

A contemporary of Le Corbusier was a famous American architect, Frank Lloyd Wright. In 1935 he published a plan for city design which in many ways can be seen as almost the direct opposite of the theory mentioned above (Wright, 1935). Indeed, in his introduction he states:

> All regimentation is a form of death which may sometimes serve life but more often imposes upon it.

Wright’s ideas went beyond the design of cities to propose radical change in the way that people live and are governed. This stemmed from advances in technology which were becoming widespread at the time, and which also echo some of the debate surrounding modern telecommunications. Wright’s ideas were that the increasing ubiquity of the automobile and developments in electronic communication could lead to an effective dissolution of the city in favour of more widespread, decentralised communities. He proposed that all families should be allocated a plot of land of a minimum size of one acre. Each family would own at least one car and most houses would contain some sort of laboratory or workshop, making working from home commonplace. The large number of individually owned purpose built houses and small plots of land would produce an environment containing a large amount of variety, but at the same time the area would be overseen by the county architect. Wright thought that this would produce a distinct character underlying the individual designs at the county level but would also produce a large variety of architecture across the country.

A major part of Wright’s model is that large scale government is largely eliminated in favour of the county government, which would own and manage all of the essential services for the area. In proposing this Wright claims that it will lead to a greater sense of responsibility for these services within the community as the ownership is close-by and accountable. Indeed, the underlying model of Wright’s plan is the development of a uniform spread of small communities across the country, which raises issues of size that we will return to later in the paper. All needs and services such as food, power and education would be produced and consumed locally. However, despite the differences between these ideas of individual space and organic community development and Le Corbusier's intense, standardised, high rise developments there are some similarities in the plans, such as the way in which they both focus to a large extent on the provision of high speed integrated road networks, and also in the division of the space into designated areas, although there are great differences in the scale of the sections.

In these two theories we have quite contrasting views of the development of city planning and, although both have were developed relatively early in the century both have been influential. We must consider from this how the ideas might apply to a virtual world. The highly centralised and structured model of Le Corbusier has the potential to provide an environment which is easy to navigate through, especially once the model on which the layout is based is known. On the other hand this was developed in the context of a highly centralised mode of the use of cities, with major businesses erecting their headquarters in skyscrapers at the centre of the city while residents moved to the suburban outskirts. In the virtual city we are freed from many of the constraints of the real world and there is no established model of city use. It may be that the balance of social to business use of the virtual environment will be significantly different from that of the real city. It is here that the individualist model of Wright is more appropriate. There is nothing to stop us allocating spatial resources to individuals and businesses and watching the city grow organically.

Other theories from city planning also make important contributions to this argument. The first comes from the noted architect Christopher Alexander. In his 1965 paper "A City Is Not a Tree" (Alexander, 1965) he argues that modern cities which have been designed from scratch along highly structured lines, having well defined and nested areas for particular uses (the 'tree' of the title,) are in many cases seen by their inhabitants as being sterile and uninteresting places to live. However, older cities which have developed gradually, and where the boundaries between different areas are more blurred, are perceived to be more interesting and vibrant environments. What underlies this is the way that the latter situation encourages the inhabitants to interact with different environments and the people who move within them. This broadening of experience helps to make the space a more pleasant place to live. Despite this we must also consider the important contributions that well defined districts can make in the city. In his seminal book "The Image of the City" Kevin Lynch (Lynch, 1960) recognises districts which have a distinct character as being one of the major features which we use when forming a mental map of the layout of a city. We must also ask what chaos might ensue if our city has an almost random scattering of different types of buildings and spaces.

What seems to emerge from this debate is a requirement for a balance between complete freedom to build anything, anywhere and the creation of a pleasant space, and the need to produce an understandable and relatively well ordered environment. This points then to an intelligent and considered policy for the management of the virtual city, but also raises the question of who would perform this management function, which we will look in section 5.

4. Small Scale Design

Design of the city on the small scale is concerned more directly with the production of a pleasant environment. The most obvious part of this is the visual appeal of the space and is concerned with design and architecture. Here variety may also be a key point to produce a city which is stimulating as well as being attractive.

However, making parts of the city pleasant to inhabit may go beyond the production of good looking buildings and into more functional domains. Some evidence to support this comes from a study carried out by and American sociologist William Whyte (1988.) The purpose of this was to look at the reasons why some of the parks and plazas in New York were more widely used than others. The plazas had been developed as a result of incentive bonuses which the city of New York had paid to developers to encourage them to build open spaces at the same time as they built each new office building. Whyte formulated a number of hypotheses as to why some plazas were more popular than others and tested them by filming the patterns of use of a number of areas. Some of these hypotheses were shown to be correct but some of the most obvious seemed to show no correlation to the number of people using the plaza and even some of those in what would seem to be the best locations were under used. Whyte looked at factors such as the size and shape of the plaza, the aesthetics and the amount of sunlight without finding a significant correlation. Finally he found that a strong factor in the use of a plaza was the amount of space available for the users to *sit down*. What with hindsight seems like an obvious factor was far from being the first to be considered. Obviously, there is not likely to be a direct application of this to virtual worlds, where sitting may not be an option for some time, yet there is a lesson to be learned that the design of a good space may not depend entirely on what immediately springs to mind.

In her book "The Death and Life of Great American Cities" (Jacobs, 1961) the writer and 'neighbourhood activist' Jane Jacobs looked at the way in which small streets can make their inhabitants feel safe. Again, it is difficult to apply this directly to virtual city streets, where physical safety will not be an issue, but a feeling of safety could be an important contributing factor to a feeling of contentment which should be attainable in virtual spaces by borrowing some of the cues from real streets. Jacob's argues that fear comes from deserted streets and from strangers. She also claims that the main enforcement of security on a street comes not from the police or other authorities but from the actions, or mere presence, of concerned inhabitants of that street. She lists three qualities that must exist for people to feel safe on a street: a clear boundary between public and private spaces, knowledge that the inhabitants of the street are observing the environment and the presence of other people making legitimate use of the street. What this leads to is that for a space to be seen as safe, and therefore as a large part of that space been seen to be pleasant, there should be evidence that the environment is being used and that there will always be other people around to observe and to observe you. This feeling can be reinforced if there is a familiarity to the activity and to the people themselves which comes from routine. In the next section we will combine this with the elements of civic responsibility discussed by Wright to suggest a model for a pleasant virtual city environment.

5. Government and Management

The issue of government is an important one if any lessons which have been learned from city planning are to be applied in an effective and consistent manner. In the case of virtual cities it is also possible to consider management on two levels, the city itself, its buildings, zones and architecture, and the underlying computer systems which drive the world and may themselves be distributed in nature. The relationship between these levels, if any, must also be taken into account.

The authorities of real cities have to carry out a very complex task. They will be responsible for managing growth of the city so that new developments, for example, are properly sited, are in keeping with the character of their surroundings, do not destroy existing features which should be retained and do not adversely affect traffic flow. They are also responsible for the provision of a variety of essential services such as street lighting, law and order and waste disposal. They must manage the city to keep it affluent by encouraging local businesses and attracting new ones into the area, possibly against stiff competition from other cities. All these tasks must be carried out in the face of pressures from interested parties such as businesses, residents groups and minorities groups.

So how will these problems map to the virtual city? The problem of managing the development and growth of the space will remain. The administration will want to encourage new people to join the community which, as can be seen from WWW growth, will lead to companies wanting to be represented within the environment too. We can guess that individuals will initially be drawn by the social aspects of the space, to meet and interact with other people with similar interest. Businesses (and other institutions, such as universities) will be drawn by advertising opportunities and, if the right facilities are provided, the chance to carry out activities such as meetings and attendance at trade shows, which in reality may require a large travel budget, without leaving their offices. Both of these types of user will have some desire to have their own individualised presence in the space, an equivalent of the WWW home page. The nature of this presence should be representative of the type of user to avoid misleading other inhabitants. Also, the location will be important. This indicates that some executive control and policy should be applied to applications for new space allocations. In effect this means planning and zoning 'laws.'

Many of the services required in real cities will not be required in the virtual space. There will be no garbage to collect and lighting will either be a global phenomenon or very easily managed on a more local scale. Services such as the maintenance of law and order will be required but in a very different way to what is seen in real cities, probably being concerned mainly with dealing with abuse of the system, unsolicited and unwanted contact and possibly some control of content where data access is allowed. Finally, there will be a separate set of services based on the infrastructure of the world such as maintaining the accessibility of the system, audio communication, other interaction methods such as billboards and asynchronous communication etc. This again raises the issue of the different levels of management in the environment.

It is obvious that underlying the virtual city is a highly complex computer system. To manage such a thing on any sort of useful scale it is probable that we will be dealing with a complex network of inter-linked and distributed systems, or servers. Each server will therefore have its own local administration for its hardware and software. There are a number of questions that arise from this: should these administrators also be governing the higher level aspects of life in the virtual city?; should there be different administrative domains in the space, and should these map onto servers, or groups of servers in the real world?; should there be a higher level administration governing policy for the whole city? The remainder of this paper does not attempt to answer all these questions definitively but, having raised them for consideration, hopefully provides some pointers for a way to move forward.

As we stated earlier in the paper, we would like to be able to strike a balance between organic growth and an orderly arrangement for the layout of the space. This, therefore, indicates that some control is necessary. We might then ask ourselves whether we are attempting to design a single integrated city or a group of interconnected but smaller communities. There are a number of reasons for suggesting that the latter option may be preferable. First, there are few restrictions on travel in the virtual environment and so movement between communities can be accomplished very easily. The splitting of the space may make administration easier by splitting the management of the groups of underlying systems into different domains. This would also be a move towards Wright's ideal of the variety of local, accountable, administrations, each with individual policies and characters, leading to a generally richer environment. Finally, there is some underlying feeling among city planners that smaller communities are in many ways 'better' than large cities, as indicated in John Brinckerhoff Jackson's paper "The Almost Perfect Town" (Jackson, 1952) and in many ways supported by writers such as Jane Jacobs who emphasise the comforts of familiarity with other inhabitants and the danger perceived to be inherent in the stranger.

What seems to emerge from these papers is a strong emphasis on the role played by community, and a sense of collective responsibility, in the creation of a pleasant city environment. This is seen strongly in Wright's ideas for bringing government closer to the people and encouraging their participation in the administrative process and the work of other authors as listed above. One interpretation of this trend is that it indicates the desire to move towards a modern version of the Ancient Greek Polis. The classicist H. D. F. Kitto, in "The Greeks" (Kitto, 1951) notes that while the Greek word *polis* is often translated as city-state it actually meant much more than this and was in many ways a philosophy of life rather than the physical entity of the city. To its citizens the polis implied a strong sense of community both in terms of relationships to other citizens and in direct participation in the administration of the city and its surroundings. This sense of involvement also brought with it a sense of responsibility which is often lacking in modern society.

Here then we have the beginnings of a blueprint for the virtual city not as a single large conglomerate but as a group of separate, but connected communities with local administrations which involves the inhabitants to produce a government based more on consensus and community responsibility than on the rule of law. This is perhaps an idealistic view, and difficult to obtain in the modern word, but something to aim for at least.

6. Summary

This paper has presented a very brief introduction to some of the issues involved in creating an on-line community of a large number of people interacting within an integrated virtual environment. Rather than focusing on the networking and systems architecture of the system we have focused on the 'architecture' issues of planning and designing the city to create a pleasant and functional environment. This was first examined on the large scale of the overall plan of the city, the needs of the users and the philosophy of the layout. Next we looked at the smaller scale of the street level and creating an environment in which the inhabitants could feel comfortable. The final section looked at the issues involved in governing the virtual city and presented a suggestion for the for of the city based on the idea of a Cyber-polis suggested by the Ancient Greek model of the city-state and associated philosophy of citizenship.

7. References

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