The City as a Process in Time and Space

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1. ABSTRACT – INTRODUCTION

Understanding urban agglomerations as a collection of dynamic processes is discussed extensively in urban design theory. Although the importance of time in urban planning is recognized widely, most methodologies and available tools for the urban design process do not support the implementation and simulation of urban processes. Although, some elements of urban design, as for example the planning of transport systems, incorporate the dimension of time, there exists a big lack in understanding the dynamic behaviour of an urban environment in various scales of time. In the international design competition “Chronopolis”, initiated in Japan, the primary design goal was to view urban development in several time spans. Several universities participated in this competition, forming four groups to design urban environments considering four different time spans, ranging from the one-minute city, the one-year city, the onehundred-year city to the one thousand year city. As our contribution was to focus on the one-year city, we developed several tasks that enabled the students to visualize the interrelationship of urban processes in time and space. Our primary aim/object was to develope specialized visualization techniques to be able to understand dynamic processes in the city of Vienna.

As a conclusion, interdependencies of the parameters with processes in the city could be detected. Furthermore the question of how urban design can cope with dynamic changes was addressed by a first basic step, leading to more insight in the complex behaviour of urban environments.

2. MAPPING TIME AND SPACE

So far the visualization of time in its relationship to space misses some expressive qualities. Generally the dimension of time is presented in an either narrative way – pointing out at temporal qualities by appealing to the listeners imagination – or in a rather crude, mathematical way – using time schedules or two-dimensional diagrams with very little visual relationship to its corresponding spatial environment. On the other hand planning disciplines developed over the last decades some very good representation techniques for the three dimensional qualities of natural and built environment. Now the job would be to use some visualization experiences of spatial modeling to representate spatial temporal processes in its spatial environment. In this project two tasks have been defined to introduce several visualization techniques for a static representation of time.

2.1 Time Geography for a one day period

The first task was to create a three-dimensional model of the average working day activities of each student for a one day period. In this visualization a map of Vienna was used to map the two dimensions of spatial activities and the third axis was used to show the progress in time. The resulting trajectories showed the student activities at the different locations in the city environment and the time spent at these locations and inbetween. The one day time span was chosen to enable the students for doing field research – that would be difficult to establish for the entire one-year period – and to cope with the representation. This technique gives a good idea of how the daily spatial-temporal rhythms of individuals look like and how they differ from each other. As soon as the amount of individuals or the time scale becomes bigger different methods of analysis and representations are needed.

Figure 1: time geography of 4 students for a one day period

2.2 Time Slices

The second task was to observe the activities of a special location in Vienna during a one-day period. Hereby students created short video sequences at this fixed location at every hour. The resulting video clips have been further processed to create so called “time slices” by cutting the block of images of a video sequence along the time axis. The resulting image creates an overview of the activities at the observed places during that period. By this technique a translation of temporal behavior in a spatial quality is achieved.

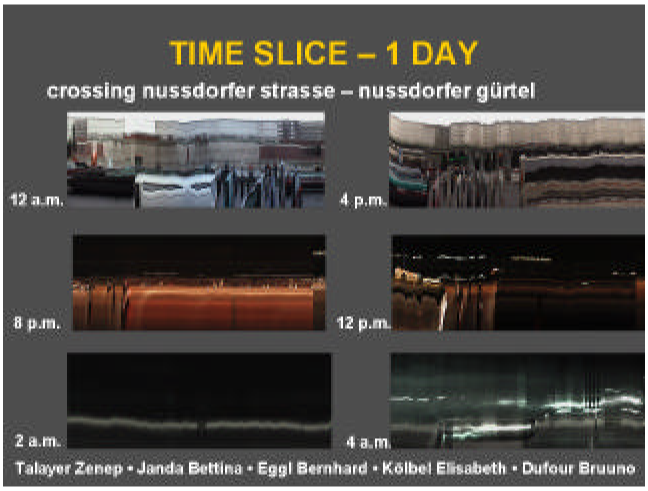

Figure 2: 24 hour period of observation, time slices of 1 minute video sequences at every hour

3. VISUALIZING URBAN PARAMETERS OF A ONE YEAR PERIOD

The third and main task of the project was to create a dynamic three-dimensional visualization of the spatial temporal behavior of a pre-selected parameter in the city. The given time span was one year. The given spatial location was the city of Vienna. Each group of students was advised to choose a favorite parameter. The first step was to choose the adequate unit of mesurement for each parameter, the time step of the data, the spatial distribution of the data and – very basic – to investigate adequate data sources. An intensive research of these parameters (pollution, wind distribution, temperature, etc.) created a large amount of dynamic data across the city landscape. Each group of students had to create a special visualization technique to communicate the dynamic change of the selected parameter over a one-year period.

The chosen parameters can be classified in different types and qualities of data: Point-Parameters, Line-Parameters, Area-Parameters and so called Thematical Parameters. Each type of parameter had to cope with special problems of data collection, analysis and finally methods of visualization.

3.1 Point-Parameters (Cinema, Baths, Birds etc)

Some parameters were just punctual interventions in the city (cinemas, baths, birds). In these cases the object was to work out the spatial qualities of the temporal change of the parameter and finally to determine the relevance of the processes at each point for the rest of the city. An interesting example in this field was the parameter "cinema". Starting with a general notion of cinemas that are distributed across the city map, having some importance for the whole city and that possess some kind of anual change – a very individual aproach of representation was developed. The "units of measurement" were the locations of the cinemas and the starting and ending date of some exemplary movies. Out of this data a complex spatial model was created giving a totally new insight of the behavior and of the temporal development of the parameter – in this case "the lifetime" of a movie.

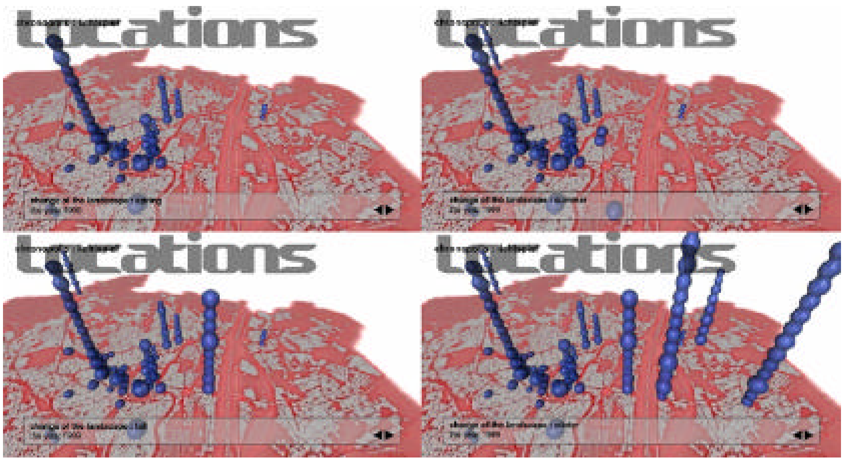

Figure 3: seasonal change of available cinema locations

3.2 Line-Parameters (Traffic, etc.)

Traffic is a parameter that has a linear character in its distributional behavior. In a very experimental setting a visualization technique was created that used the metaphor of the human blood support system to create a rhythmically pumping three-dimensional tube system. Hereby the diameters of the tubes were modified to visualize increasing and decreasing traffic densities. Therefore a larger amount of traffic would require a higher amount of space inside the city. Hereby an intersection with the framing buildings around a street system would indicate a conflict between available and necessary space for the traffic system.

3.3 Area-Parameters (Wind, Pollution, Sound, Light&Shadow etc.)

Parameters that are distributed continously over a selected area (wind, pollution, sound). In these cases representative measurement points had to be chosen and consequently the problem of interpolating the values of point measurements upon the corresponding area had to be solved in an adequate way. This type of parameter needed the most careful selection of data.

In the case of wind the data was available only at very selective points in the city and the available data only gave a very generalized information of the dynamic behavior of wind in Vienna. In this case the focus was placed upon the visual translation of the qualities of wind in a selected subarea of the city. The result is further away from the measured data but gives a very good sensation of the qualitative aspects of wind processes.

The approach which was selected for the parameter pollution is rather different. In this case good series of measurement were available at representative points of the city. The first approach was to create a dynamic mesh of selected sub-parameters by interpolating between the single measurement points. A statistic evaluation of the significance of the interpolated values had to be done in this case. In a next step interdependencies between locations and different parameters at each point of time were observed and evaluated.

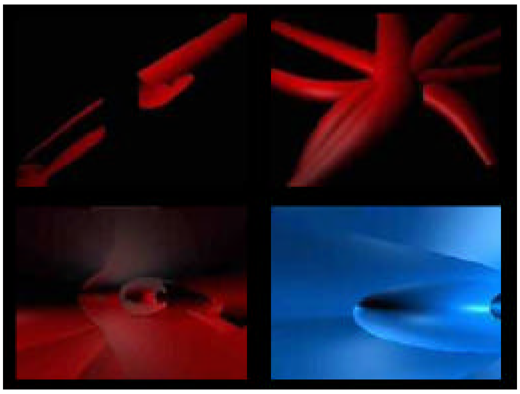

Figure 4: visualization of traffic densities

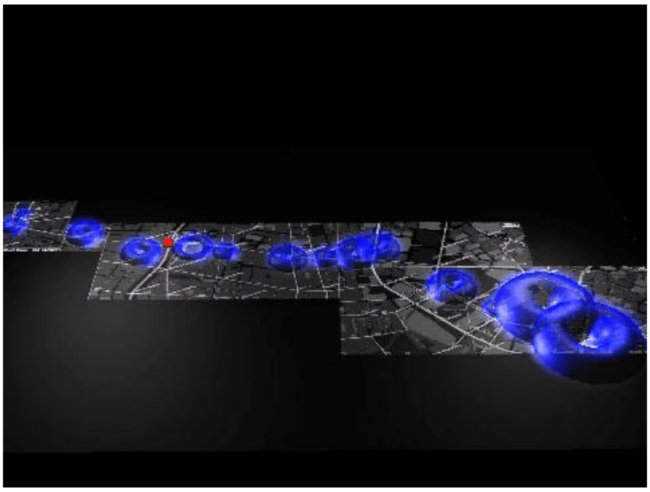

Figure 5: visualization of the parameter wind across a selected route in Vienna

Figure 6: visualizing change of pollution at the points of measurment

3.4 Thematic Parameter (Homeless, Urban Legend)

Finally there were parameters which aimed at the observation of rather cultural layers of the city (lhomeless, urban legend). By means of these parameters phenomenons which are part of the city but which are normaly hardly perceptible were made visible in its spatial temporal structure for the whole city. A very sensitive aproach was developed to show the spatial dynamics and the spatial locations of homeless people during a one-year period. A very basic reality within the city was brought into consciousness by focusing on this city layer, showing that a mesh of spatial temporal realities of homeless people exists all over the city. A very different approach was used to visualize the layer of cultural festivities in Vienna. First an analysis of the different dates and sites of religious and secular festivities was done. Visualizing these data over the city map for the time span of a year gave a good impression on how different realities coexist very close to each other. In a next step a type of meta-layer was developed connecting the variety of cultural layers by means of a futurist invention.

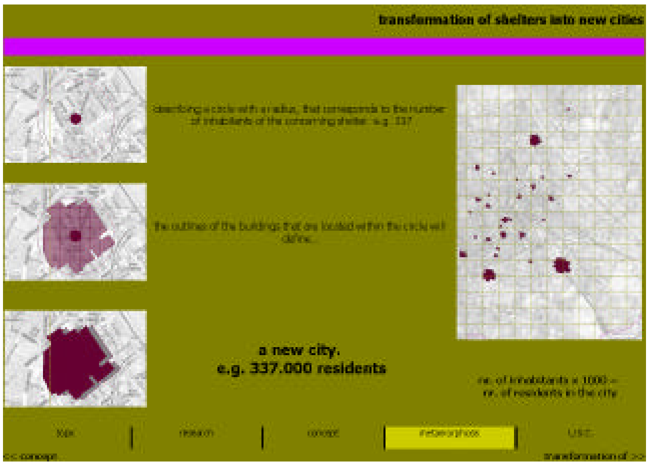

Figure 7: creating a modified map of Vienna by mapping special places for homeless into a new thematic map

Figure 8: a urban legend marking and linking several „artificial“ events as a map in time

4. CONCLUSION

The scope of this project was to create a principle understanding of dynamic processess inside the city. It is a very challenging and interesting approach to investigate this topic as several problems have to be solved simultaniously. First of all, data has to be collected in a consistent and accurate way across spatial and temporal extensions. If not all data can be collected within the same spatial or temporal density some suitable interpolation method has to be developed to fill in the gaps of missing data. A key element of the understanding of dynamic processess is to develop new visualization techniques that can communicate to complex spatial temporal relationships of urban processes. We see this project as a first basic step into a new and very challenging research area into managing and understanding of sophistacted urban scenarios that will develop some new methods of future urban planning.

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PARTICIPANTS

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