APPROPRIATE 3D-ENVIRONMENTAL SIMULATION TECHNIQUES

THE RUHRALLEE TUNNEL ROAD EXPERIENCE

J. Alexander Schmidt
University Duisburg-Essen

Abstract

The Ruhrallee *is a historical arterial road connecting the wealthy south of the city of* Essen *with the region south of the city. The old sycamore alley gives the low-density residential neighborhood its spatial qualities and its own identity. But the spatial and social potentials are not legible and livable due to the heavy traffic on the existing road cutting the neighborhood. The street cannot assume its spatial function.*

Therefore the City of Essen *and the Federal Government want to build a tunnel road under the existing street, in order to improve the situation for the neighborhood.*

The Institute for Urban Design and Planning in cooperation with the Institute for Traffic Planning at the University of Duisburg-Essen carried through an evaluation of various scenarios in terms of traffic flow and visual intrusion of the planned tunnel road as well as the refurbished old street space. The main focus of the study is the integration of the tunnel entrance and the proposed road alignment into the existing urban fabric. The 3D-environmental simulation plays a key role in the analyses, the planning and design process, but also in the decision making process.

The paper examines the results of the analyses and the various design schemes. It shows that analogue simulation is still an important tool for urban design and other related planning disciplines. But the paper also points out that 3D-environmental simulation can help to make urban design topics more comprehensible for other non planning disciplines.

Background

Many planning experts view the use of 3D simulations as an essential part of project planning and decision-making. However, such simulations are also complex and cost-intensive. It is precisely for large structural interventions in urban areas and large-scale city planning projects that the visualisation of planning and design alternatives is more important now than ever – to inform the public, as well as to allow project participants to reach decisions.

Figure 1: Daily traffic jams on the Ruhrallee

Figure 2: Dense rows of trees shape the urban space

However, owing to the poor financial position of cities and municipalities, 3D environmental simulations are increasingly being seen as dispensable. Official city planning agencies can often only commission plans that are either absolutely necessary or else plans that have been demanded due to the pressure of citizens. Even when planning fees are being negotiated economies are made in every area. Straight away, unnecessary services are irresponsibly eliminated from performance requirements and tenders. Ultimately, when considering either a spatial representation of a project or a 3D environmental simulation to evaluate town construction concepts and their alternatives, there is often no place in the budget for the 'luxury' version. This situation is not at all a responsible one, considering the background of urban structural change and the variety and complexity of planning tasks.
In contrast, wealthy clients and investors do not shy away from any costs associated with presenting their construction project in a more seductive and winning manner, using virtual worlds and slick representations to do so. In this case, 3D environmental simulations are primarily used as a tool by the marketing department.

Working hypotheses

In view of this situation, a number of fundamental issues now arise concerning the meaningful and purposeful employment of 3D environmental simulations within local planning practices for city planning projects.
The issues surrounding visualisation with 3D environmental simulations may be summarised into three working hypotheses:

- Simple techniques – quick and dirty

Three-dimensional environmental simulations can be very time-consuming and expensive, but they may also be performed using very simple and therefore inexpensive techniques. Which simple and economical means could be used to effectively represent future environments as realistically as necessary but also as simply as possible?

- Orientation to target groups

It could be that the different participants within a planning project have different requirements as to

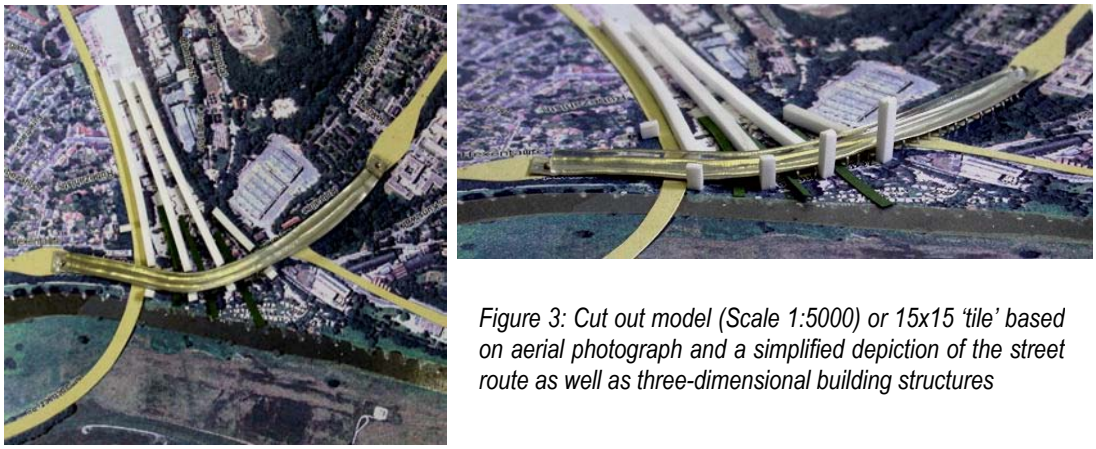

Figure 3: Cut out model (Scale 1:5000) or 15x15 'tile' based on aerial photograph and a simplified depiction of the street route as well as three-dimensional building structures

how realistic visualisation simulations need to be for the exchange of information and communication between parties as well as for decision-making. In concrete terms, how simplified and economical can the simulation be made while still accommodating the requirements of all involved parties?

- Reduction of complexity

Engineering specialists often tend to overload plans with unnecessary information to an extent that the truly important features are no longer discernable to the layperson. Can 3D environmental simulations be of meaningful service in this case?

Ruhrallee Tunnel Road Project – a dialogue between urban design and transportation planning using 3D environmental simulations

In order to better understand and evaluate this targeted approach to simplify and reduce the costs of 3D techniques for visualisation and spatial simulations the following discussion provides an outline of the project and its surroundings.

Located in the heart of the Ruhrgebiet, the city of Essen is a linkage point where roads from all directions intersect – however not all routes function equally well because the transportation network is based on earlier structures that have expanded through time. The network has not yet adapted to the new regional linkages.
In particular, connections from the cities and municipalities lying to the south have been neglected for decades. For the southern periphery of the city, daily traffic jams and extreme traffic volumes are the results in evidence today. The principle link is the motorway leading to the city limits of Essen, which then abruptly ends and transforms into a regular city street. Further along, the route leads to another motorway and proceeds to the town centre of Essen.
This city street is called the Ruhrallee and with a traffic flow of over 60,000 vehicles per day it has reached the limits of its capacity. A fundamental task lying ahead is to create an efficient gateway to the city; one that will reduce the traffic conflicts between the southern-lying municipalities and the city of Essen. One remedial proposal involves building a tunnel to convey flow-through traffic while the existing street would be demolished, allowing for the creation of new urban spaces. At the same time, relieving this street of traffic could be regarded as an impetus for structural change in the city quarter and would constitute an attractive link between rural landscapes and city structures.

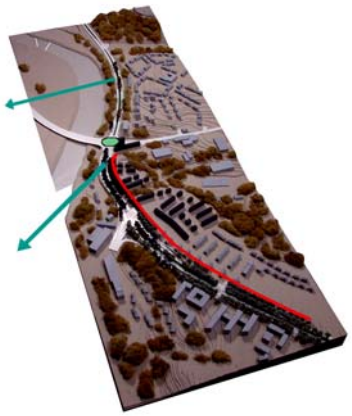

Figure 4: The to-scale working model (1:1000) for the most important section of the planning area
Figure 5: Drawing over the model photographs to emphasise the important planning goal

A citizen's initiative has taken up this issue, the political groups are already preparing for the coming election campaigns and even the chamber of commerce is pressuring the project forward by providing financial support to associated planning projects.
Normally, in the past, transportation problems would be solved by transportation planners – nevertheless it is well known that this sectoral approach to problem solving often generates a whole new set of problems. Therefore, in this case the client stipulated that both a city planning and a transportation planning approach be taken to problem solving – an integrated planning process.
In this case, the mode of proceeding was shaped by the close co-operation, or better described, the dialogue between city planning and transportation planning: design ideas prepared by the transportation planners were critically evaluated by the city planners. In the worst case ideas were rejected and in the best case they were optimised. The process involved sketching and rejecting. Parallel to this process, a number of guiding principles related to urban design were developed for use in the evaluation of transportation and city planning solutions.

This was the framework behind the employment of environmental simulations.

3D Environmental Simulation and Appropriate Techniques

The following discussion outlines the various rudiments involved in a budget-dependent, target-group oriented and informative 3D communication process.

- 15x15 tiles

In the first phase of the project, it rapidly became necessary to furnish transportation planners with conceivable guiding principles of urban planning to avoid the making of hasty preliminary decisions regarding the transportation planning solutions. This requirement provided the first opportunity to use simple 3D visualisation techniques: small 'tiles' (15/15) based on aerial photographs supplemented with simple drawings and three-dimensional building structures were used to clarify the various alternatives.
These tiles helped initiate a number of discussions, which partly focussed on fundamental issues, since the transportation planners could see each favoured variant in terms of the urban design and landscape planning consequences. The results of working with these very simple models resulted in the selection of a limited number of variants to be given further consideration.

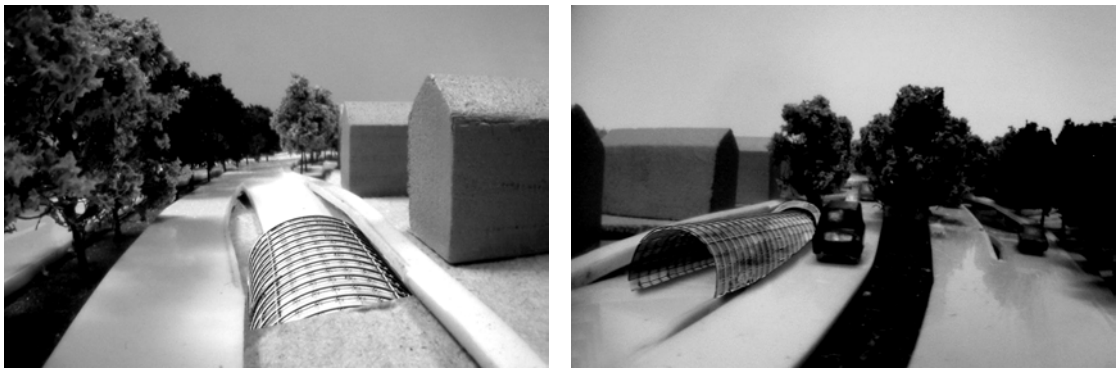

Figure 6: Insertion of best practice examples to enhance the descriptiveness of the rough-seeming endoscopic photos of the working model: 6.1. Tunnel exit; 6.2. Vent stack of the tunnel ventilation

- Working model (1:1000) and endoscopic model photos

In the next phase, a scaled working model was built, which was initially only used to depict the existing topography of the area. In addition, the project group used the model before detailed planning was begun in order to graphically represent the urbanistic intentions of the planning, to outline the tunnel alignment and to site compatible locations for the tunnel portals. This work was completed before transportation planners applied complex CAD programs to determine, to the centimetre, the exact position and height of the tunnel.

At the same time a number of other designs was being tested on the working model, including designs for a memorable and impressive gateway to the city as well as alternatives for noise protection features incorporating new urban design patterns suitable to the location. In addition, exemplary designs employing best practices were superimposed onto photos of the simple working model in order to clearly support the simple working model depictions.
Photographs of best practices examples served to support this communication process, which used an extremely simple model. The simplicity of the model thereby make the endoscopic photographs very rough in nature, even when considering that a certain sense of abstraction was expected from the participants. However, it has been shown that simple examples can sometimes 'translate' and 'enliven' the demure plans of engineers instead of using complex model simulations.

- Model pictures and site pictures

Using the techniques of superimposition or montage of endoscopic model pictures onto site photos worked against another phenomenon: Normally, site pictures exhibit such a high degree of complexity that the untrained viewer has difficulty in recognising what the intended message in the picture actually is. The density of information contained in real photographs often covers the actual message that needs to be conveyed. A montage or linkage of endoscopic model pictures and reality can make the picture more descriptive.

Comparable results can also be attained using digitally reworked site photos or the superimposition of simple drawings over real photos.

Figure 7: Endoscopic model photo (7.1) and its superimposition over the existing natural space (7.2)

Blurriness and sharpness

The examples introduced here from the Project *Ruhrallee* have demonstrated that varied and uncomplicated forms of visualisation are possible, including forms of 3D environmental simulation.

This project involved the production of environmental simulations with little investment of effort and within the limits of a severely restricted budget. It also used simple means to produce visualisations matched to the target groups that were both project specific and dependent on the project content. The insights gained from the project may be summarised by two classical quotations:
Nature loves to hide itself. (Heraclitus)

In light of past experience, in many planning situations it is difficult to see and to recognise, to depict and to represent the fundamental issues and crucial planning aspects of the project when the 3D environmental simulation is already too detailed, too realistic and too perfect. Rather, it is often important to simplify the circumstances to be represented in order to reveal what is truly essential and crucial.

The participants themselves do not see clearly, only those who view from afar. (Lao Tse)

When the contents of a simulation are represented too exactly or they strive too much for perfection, one cannot perceive the fundamental and crucial aspects of planning. However, if in the course of planning using simulations the components can also be depicted indistinctly, then it is easier for the observer to recognise decisive elements and to perceive what is important for the decision-making process.

The well-known 'fuzziness principle' can also be effective here. In analogue or digital 3D environmental simulations the aim is not merely to produce photograph-like virtual worlds brought into being through much effort, the results of which can then be used for the purposes of communication and information, as aids in decision-making processes or for marketing. Instead, less involved simulations can be targeted to consciously reduce the complexity of pictures and attain the associated aim of simplifying the visualisation of a project in order to improve the readability and comprehension of the project aspects.

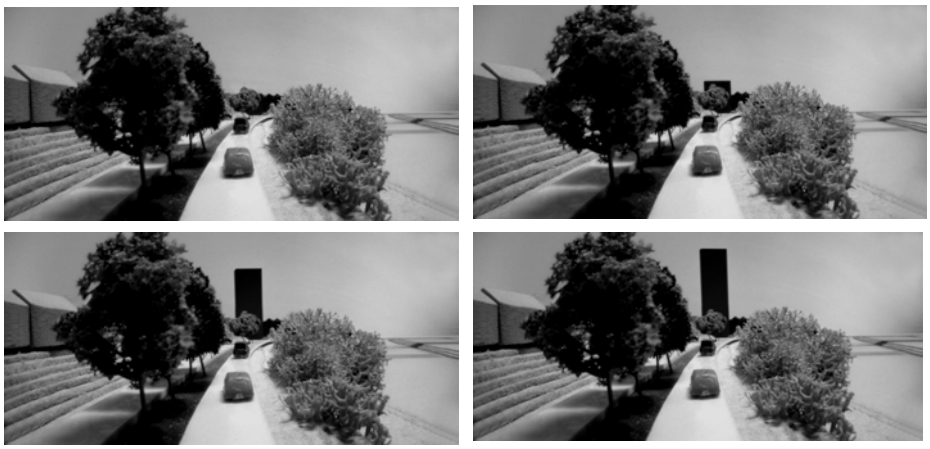

Figure 8: Endoscopic model photo (8.1) digitally reworked to show the variants for the height of the city gateway structure (8.2).

Acknowledgements

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Figure 9: Rendering site photos readable using targeted 'blurriness'