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Visualisation of Unbuilt Buildings in their Landscape

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Abstract

Computer modelling can provide better information on building projects presented in two dimensional drawings but never built. A cemetery project in Denmark was formed as a solid model in its sloping landscape using Softimage. Boolean operations were used to position walls at a given height above the terrain. More accurate still and video images were made and compared with original sketches.

1. Introduction

There are many unbuilt designs by famous architects which were presented too inadequately to be fully understood. We now have visualisation techniques which can use the published data on these designs to explain such buildings more fully with multiple 3D views and animation.

One such project was submitted by the Finnish architect, Alvar Aalto, to a competition in Denmark in 1951. It was unsuccessful but the Graphic Communications group at the Technical University of Denmark has now modelled the design and discovered that one of the drawings was rather imaginative. Nowadays more precise information is expected and it is possible to submit computer models, which competition juries can explore to obtain more complete and accurate information.

The computer techniques employed by DTU are well established ones but involved modelling a building, positioning it on an accurate site model with landscape features to show the design. SoftImage was used on a Silicon Graphics Indigo 2 and, both still and animated views of the building in its landscape, were produced.

2. The Lyngby cemetery

The Kommune of Lyngby Taarbaek in Denmark ran a competition for the design of a cemetery chapel and its surrounding graveyard in 1951. One of the entrants was the famous Finnish architect, Alvar Aalto, working with local architect, J J Baruel. He was awarded second prize for the chapel but was not in the first three for the landscape. The winning design, by Henrik Iversen and Harald Plum, was built and now occupies the more level area on the south side of the site.

On the north side of the site are two shallow valleys which form an attractive landscape in the relatively flat Danish countryside. The choice of the winning design may have been influenced by a wish to keep these valleys in their natural state, as grassland with wild flowers.

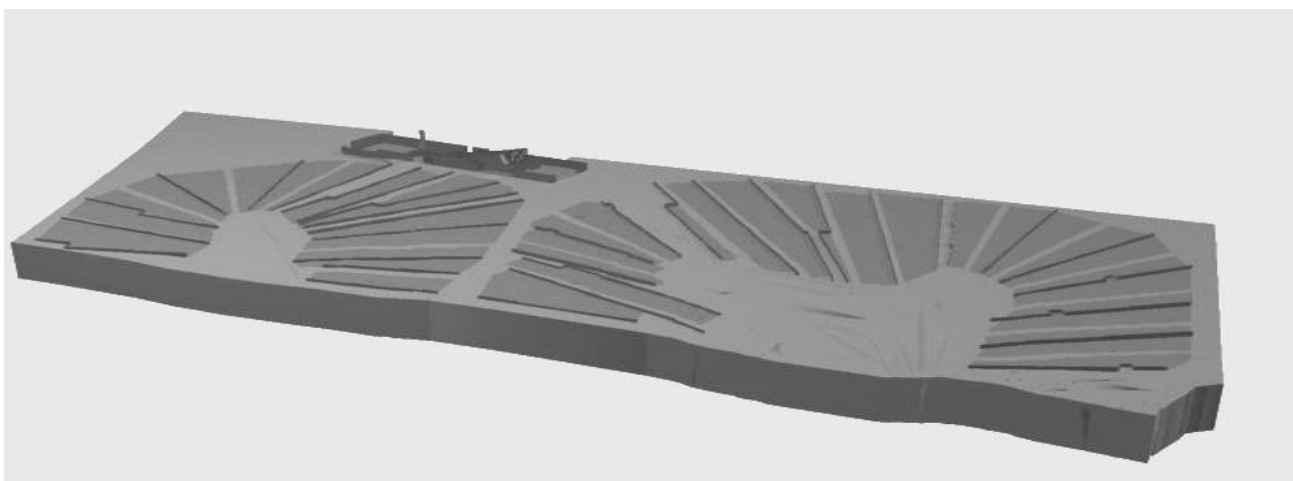


Figure 1. View of chapel and graveyard from above

Aalto's design opted to use the tops of the valleys for placing the graves in wedge-shaped areas defined by walls running down into the valleys, and to provide channels for the supply of water for flowers left at the graves.

The chapel building he placed at the top of one of the valleys. A sketch of his proposal for the graveyard seen from below shows a romantic view of steeply sloping hills with planting leading up to the graveyard area and the chapel.[1] Figure 2.

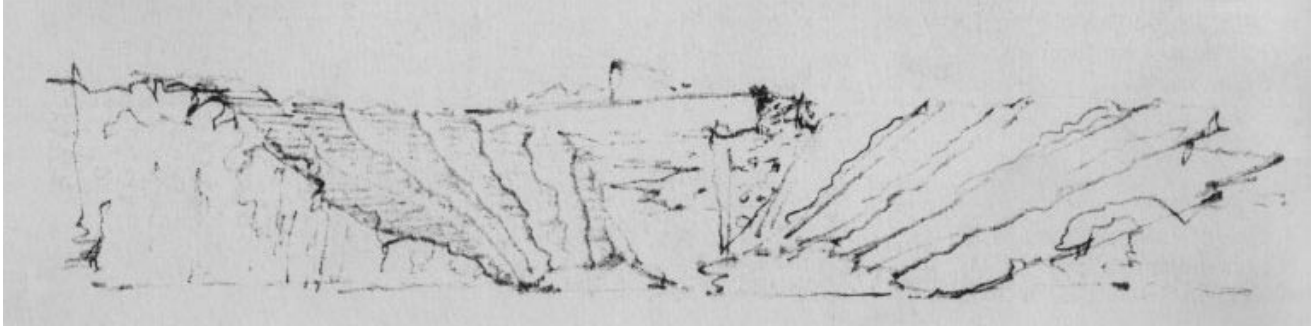


Figure 2. Sketch by Alvar Aalto of his design for Lyngby cemetery



Figure 3. View of model from the same direction showing actual slopes

Did he ever visit the site? The steepness of the slope indicated in his sketch is more reminiscent of an Italian hill town than the unspectacular Danish landscape. It shows the graves, typically placed between hedges, sheltered by walls with extensive planting. We can now model the

buildings from his drawings and the site from surveys, and provide more topologically accurate images of how his design would have appeared, but without the planting. Figures 1, 3, 4.

3. The techniques used

Ernst Petersen has worked on integrating video with models of unbuilt objects looking particularly at how to compensate pictures taken from a car for the movement of the camera. He modelled the Aalto design mainly using the program SoftImage installed on a Silicon Graphics Indy workstation. The process of modelling was divided into three elements: the ground, the graveyard walls and the chapel building. At the end the models were put together, placing the walls and the building at the locations shown in the Aalto drawings. The background materials for the model were copies of drawings and a video, made by DTU, of the original wooden model kept at the Department of Building in the town hall of Lyngby-Taarbæk.

Placed on the hard disk the bitmap file was converted in a two-stage operation into a vector file and then into splines in the three-dimensional space in SoftImage. Within this space the contours were combined into pairs and made into solids. Each solid's top face represents a one metre step and shows the surface of the ground. Together these surfaces show the entire terrain.

A series of selected still views was obtained from the video of the wooden model for comparison with the digital model during the process of virtual building. The first phase, the ground, consisted of several steps. First reproduction of the contours of the site through manual drawing, then scanning this drawing into the computer.

The positions of the graveyard walls were found by means of tracing contours. The map showing the entire site with contours, building and walls was scanned into the computer. The bitmap image generated was redrawn to show only the boundaries of the site and the profiles of the walls. These profiles and boundaries were converted into splines by the 3D program using an autotrace function. Once traced, the splines were put beneath the ground model

in wireframe mode and scaled to fit the model. Walls were placed at each profile and scaled to their individual lengths. There was little published information about the walls but their height was set at two meters above ground level, stepping down half a metre at each one metre contour and between each pair of contours using Boolean operations to fix the heights above the ground.

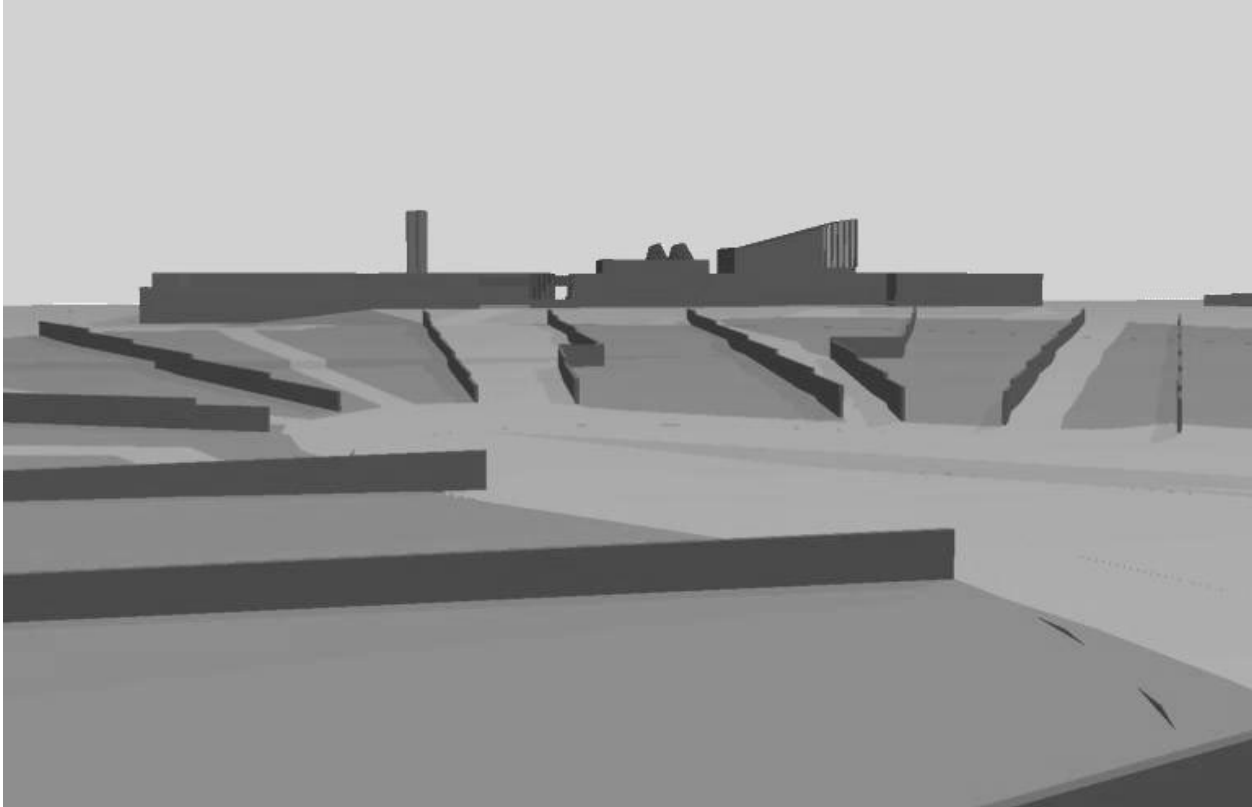


Figure 4. View of chapel across a valley showing walls dividing graveyard area

The building plan was similarly scanned and the wall structure copied by digital drawing. This copy was edge traced and converted into splines in the 3D-program. The spline structure served as the outline on which the walls were placed. The walls were made out of solids scaled to fit the length and width of the outline beneath. There was no indication of heights from the scanned drawings, so a baseline had to be found. The overall length of the building was known to be 155 meters from dimensions on the drawing. A base line of the building's total length was divided by 155 and a one metre base line found. With this tool the building heights taken from the drawings were transferred to the model. The vertical location of the model was fixed by adjusting the relative heights of the model so that marks on the walls, measured to be where the walls meet the ground, intersected with the contours.

The areas of the graves, normally separated by low hedges in Denmark, were indicated in a darker colour, and these too give an indication of the site surface which, in gently sloping areas, can be difficult to represent in computer models. The contrast between the model view, Figure 3, and the original competition sketch, Figure 2, even allowing for the simpler presentation in the model, is quite significant. The animated views, which are accessible on the DTU web site, [4], showing what would be seen when walking up from the valleys, through the graveyard, towards the chapel, provide even more information about what the experience of moving through this design might have been like.

4. Computer models allow better understanding of design

If Aalto had had the computer tools available today, he could have made a more accurate submission and we might now have a landmark building on the site. There are other such models being produced to reconstruct historic buildings or archaeological work as well as the unbuilt designs of modern architects. Students of architecture at MIT have also modelled famous buildings including photo realistic images of Aalto's competition entry for a church centre in Zurich Alstetten, Switzerland, by Andrzej Zarzycki <http://www.gis.net/~zarzycki/aalto.html> [2] Virtual libraries of both built and unbuilt buildings are being created and can be viewed over the Internet. Figure 5



Figure 5. Photorealistic view of interior of Aalto church in Zurich by Andrzej Zarzycki

Architects have been known to distort views of their buildings or, at least, to present only the most favourable views. If computer models are submitted in future, then competition juries, local planning authorities and the public, would have the ability to view them from any position and gain a fuller understanding of the design.

Many of the most sensitive buildings are in an urban context where relationships to existing buildings are important. For example the competition for Paternoster square next to St Paul's cathedral in London involved each of the shortlisted entrants in setting up computer models of the surrounding area. Municipalities could supply such models as the context within which a design proposal is to be presented. This would require a standard co-ordinate system and a defined relationship to the mapping grid. Such a standard, which may emerge from Geographical Information Systems work, would allow models of parts of a city to be combined into a model of the whole city, to be maintained by the municipality.

At present such models in the UK have been produced by universities using student labour for such cities as Bath [3] Figure 6, Glasgow and Edinburgh, but each uses a different approach.



Figure 6. Bath model - Centre for Advanced Studies in Architecture, Bath University

5. Conclusions

In the case of Aalto's design for Lyngby cemetery, there was an absence of contextual information and what might have become a landmark building was never built, although the cemetery that exists is also good. Nowadays landmark buildings have enormous value to cities. You have only to look at Sydney Opera House, designed by a Danish architect and engineer, and now a symbol for the whole of Australia. More recently Frank Gehry's Guggenheim Museum at Bilbao has boosted the reputation of that city enormously.

With such dramatic forms and famous architects there is bound to be controversy, and good presentation of design using computer models, visualisation and video montage will inform such discussions. Very often the complex forms which occur in landscape can only be presented in models. These can be shown as still images, animations or virtual reality and can promote the place where the buildings are located. But who, outside Denmark, has heard of Lyngby?

Acknowledgements

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