Progressive 3D Modelling of the Theban Tomb 32

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Abstract

The presentation is a virtual reconstruction of the Theban tomb 32, which aims at modelling the topographical placing of the architectural mass and how the area was built in on a ridged surface. The densely built in areas of the preferred slopes of the Theban cemetery are visualised in space, as well as the layout survey - thereby helping the chronological classification of certain structures. The elaboration of detail in architecture, sculpture and painting tries to understand the structures better and to discover the planning-artistic concept from a new viewpoint. The 3D reconstructions of the fragmental structures throw light on excellent workmanship - and give away those awkward solutions which would not have been visible on 2D drawings. Alternative proposals for ambiguous details or for those which cannot be accounted for from the layout can be visualised in a 3D model. The find assemblage is of significance, the mass reconstruction of the interior scenes and use of space makes the visualisation of the interior complete. During archaeological excavations most of the contexts are not intact, thus real and virtual reconstruction of fragmental and incomplete states is unavoidable. Placing the finished models into the architectural environment is a testing of tomb-reconstruction, but at the same time it also provides a picture which rarely comes up in excavations.
Besides the presentation of the reconstruction we also wish to show how this is relevant in the assessment of scientific results, apart from offering an aesthetic outlook.

Nowadays, computerised representation of architectural structures and historical relics amounts to nothing new within the field of archaeology. The multifunctional application of the computer for the assessment of archaeological data brought forth novel results from a scientific perspective as well. Modern exhibitions, in situ presentations and popularising publications are an opening towards the wider audience, thereby creating an increasing interest on the part of the public towards archaeological results.

The aim of computer-aided planning and modelling is to expose and get acquainted with contemporary professional skills, creativity and innovative thinking, besides creating virtual reality displays. Thanks to ongoing software developments, modelling is increasingly successful in capturing the richness of surface detail and the materials used. The photo-realistic representation of virtual reality is a general expectation towards modelling.

The material to be presented is the architectural-archaeological reconstruction and virtual modelling of the spatial structure of the Theban tomb no. 32 and its close environment. Apart from representing the architectural units, we also wished to give an account of the chronology, that is, presenting the periods the environment in question was used - through the course of thousands of years. The tomb was constructed during the reign of Ramses II, in the period of the New Empire, as the final resting place of Djehutymes, a principal fulfilling various important positions. The excavation of the complex started in 1983, with the clearing of the underground areas. Excavation of the forecourt began in 1986, while the pyramid was uncovered in 1997-98. During the excavation of the outer court, several former burials and earlier structures came to light (Fig.1).

Computerised-digital processing started after the surveying and the architectural reconstruction had been completed. The survey drawings, aerial and site photographs, the find assemblage and analogies were our points of departure. The 2D processing of the drawings compiled for the presentation was

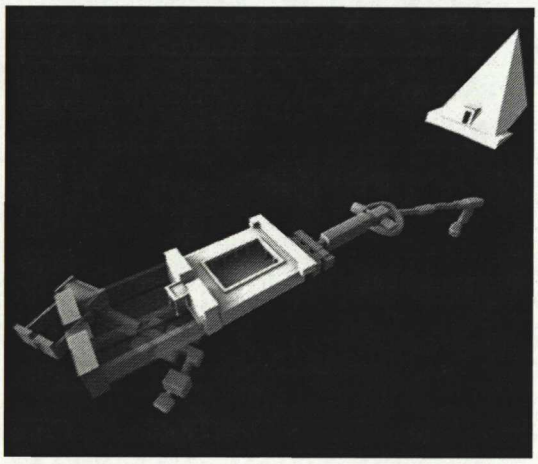

Figure 1

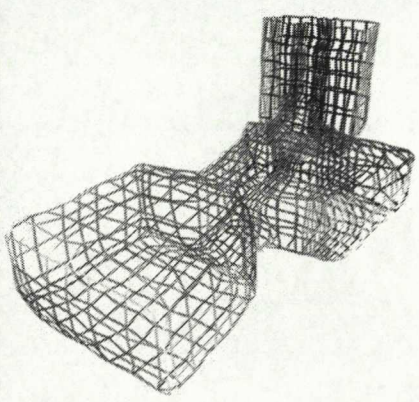

Figure 2

created by the Autodesk Architectural Desktop Autocad platform. For the 3D modelling, we used the Autodesk VIZ4 software, which is compatible with the 2D system. The structure of the model was determined by the chosen software; in this case this is a surface model created by bitmap-based shading, mapped onto a wireframe. The courts below the surface, the pyramid and the chambers which can be traced back to simple geometrical shapes were created by typical architectural modelling practices. The individual, built-in elements are composed of parametrically based solids.

The mapping of the organic and amorphous spaces and surfaces was created by polygon-based modelling. The sub-object level polygons, vertices and edges provide the tools of modelling.

To give an account of the modelling process; we would like to present the following stages and illustrations:

1. wireframe building (Fig.2)
2. built-in smoothing
3. bitmap-based shading
4. rendering

With the help of 3D modelling, exciting virtual models can be constructed, besides uncovering the structure of the tomb. Such an element of the tomb is this painted relief detail from the second chamber. The picture depicts the entrance of the tomb, which has a portical structure, with the pyramid above. During the architectural reconstruction, a construction very similar to the Deir el-Medine tomb pyramids came into mind. After several unsuccessful excavation seasons, the expedition discovered the pyramid nearly exactly over the tomb - though 35 metres higher. The unambiguous connection was provided by frescoes from the inside of the pyramid, bearing the name of Djehutymes. Although the pyramid is situated 70 metres away from the entrance and is located 15 metres higher, it shows the picture depicted in the tomb - as it can be seen on the CAD-design. The iconography - as well as the actual existence of such representations - can become the focus of study. As our example also shows, the strict representational conventions nevertheless allow for realistic depictions (Fig.3).

The reconstruction of the statues is a significant and spectacular part of virtual modelling. The inner court, facade and first chamber of the former complex contained twenty-four high reliefs. In addition, fully sculpted statues must have stood between the columns and in the inner areas. The life-size representations in the chambers that were carved into the rock managed to survive more-or-less completely, while those in the court got very damaged. However, by reconstructing the large mass of excavated stone fragments, first the faces and then by the process of proportioning the bodies themselves could be modelled. The detailed reconstruction of the spatial structure gives an account of the tense, dynamic characteristics of the contemporary space; while it also provides a system of differing visual displays in the course of time. The court model might help to locate the original positions of the thousands of stone fragments, though it might also be useful in the preparatory stage of in situ presentation (Fig.4).

During the excavation of the outer court, several earlier burials and Late Period structures were unearthed. These structures - taking the environment into consideration - are usually chambers that were carved from horizontal shafts. On the presentation an adobe structure is clearly visible, which - during its construction - ruined the forecourt of the tomb. The modelled "negative spaces" presented here shed light on the archaeological-architectural feature of the Theban cemetery, and characterise its structured aspect, even within this small segment as compared to the much larger whole. The actual cemetery extends over several square kilometres, the area that has been excavated by us is only a couple of thousand meters. The main purposes of the construction of the virtual model was to present the below-surface areas of the cemetery and to further the precise determination of chronology.

The environment of the tomb of Djehutymes was segmented by the construction of earlier graves, chambers carved out of rock and several courts. The rock quality of the region differs from layer to layer and the continuously widening gaps further render stone cutting more difficult. This is why excavations are dangerous, and 3D documentation ever important. The wall face of the chambers and facade follow the plains of larger rock movements; documenting these processes can provide us with valuable information regarding the strengthening of the rock walls and the consolidation of the remains. These factors made the preparatory planning stage and the actual execution all the more complicated even in ancient times. The strange axis changes observable on the ground plan structure also reflect the complexities of the architectural conception and the difficulties that had to be faced during

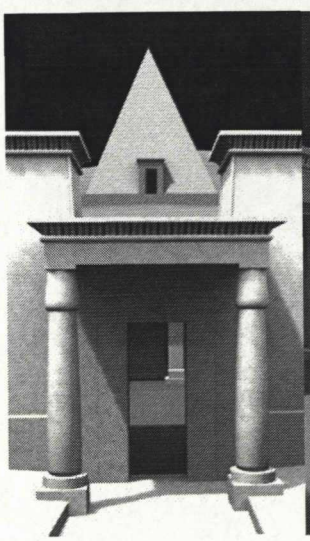

Figure 3

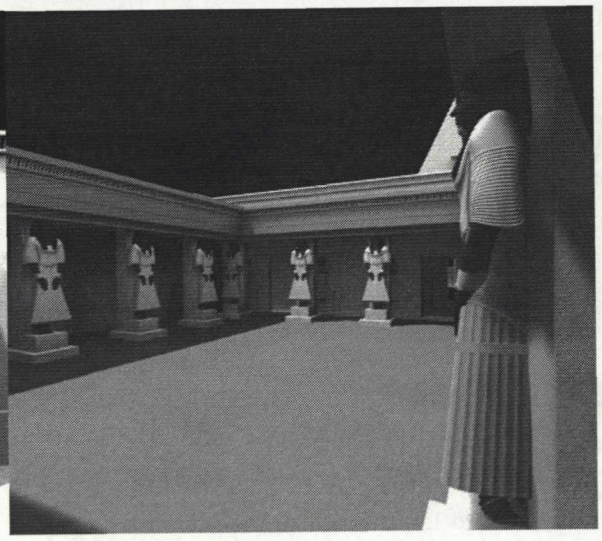

Figure 4

the realisation of the plan itself. One had to adopt to the circumstances and conform to the contemporary conventions regarding the construction of tombs. An interesting example of strict axis composition and creative planning can be seen in the connection of the tomb's courts and the parts that were carved into the rock. The neighbouring tomb which was constructed during the 18th dynasty and a most probably unfinished tomb on the western side determined the maximal width that could be carved out or constructed. Thus, the axis of the first chamber is not in line with the axis of the proportionally designed courts. In order to balance the anomaly, a facade with half-statues, a stele and a false door was constructed; one of its secondary axes is the actual entrance of the tomb. This apparent solution created a problem on the eastern side, the planned symmetrical composition could not be attained. The remains suggest the construction of a further, unknown element beside the entrance. Answers will be provided after the stone fragments have been processed.

Figure 5

By the construction of the complex, we wished to model the topographical location and building of the architectural mass on this highly segmented landscape. The exceptionally dense building of the preferred slopes of the Theban cemetery is presented in space as well - besides the ground plan surveys; thereby helping to establish the chronological ordering of the specific structures. The finish of the architectural, sculptural and pictorial details aims at a higher-level understanding of the structure and the discovering of the planning-artistic conception from a new perspective. The 3D reconstruction of the fragmentally survived superstructures shed light on the contemporary master strokes of design and at the same time give away the awkward, less-successful solutions - which otherwise would not have been visible in a 2D model. 3D modelling can visualise alternative suggestions for details that cannot be decided straightforward or cannot be deduced from the ground plan structure, thereby presenting the best possible solution.

The mass reconstruction of the significant pieces of the find assemblage make the visualising of the interiors and presumed burials possible. During archaeological excavations, undamaged, complete contexts are very hard to find. Due to grave robbing and art collecting, the virtual reconstruction of the fragmented, incomplete state is highly desirable from a scientific point of view as well. Placing the finished model into the architectural environment can be seen as tomb-reconstruction, a trial of the burial and also provides a sight very rarely experienced in reality at archaeological excavations (Fig.5).

Besides presenting the reconstruction, we would also like to introduce those possibilities which might play an important role in the assessment of scientific results, besides offering an aesthetic experience.

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