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FROM THE ENLIGHTENMENT TO THE *DIGITAL SUNLIGHT SYSTEM*. REALISTIC VISUALIZATION OF COUNT POTOCKI'S LAURENTINE VILLA. PROGRESS OF THE WORKS
(PL. 44-47)

Over the last years new technologies have opened up countless opportunities for the world of science and *building virtual (digital) worlds* is one of most interesting among them. Up till now this technology, which has developed since the beginning of the 1990s and has been successfully used on a large scale over approx. ten years, has generated a fully developed range of instruments providing invaluable help in practically all aspects of human activity. As examples may serve "virtual copies" of objects, buildings, or cities existing in reality, the surface of the Earth (used in forecasting weather and long-term climatic changes), medical, nanotechnological, and bio molecular virtual models, astronomical simulations, simulated social and economic processes, simulations of potential military actions, as well as a wide spectrum of visualizations of concept projects of any kind – from objects of everyday use to digital special effects in electronic media[1].

The steadily increasing computing power of PCs opens up more and more possibilities for the Humanities too, as they have still usually employed traditional research methods. Using *virtual worlds* in archaeology – at a level of documentation as well as in popularization and reconstructions – may serve as an excellent example. Methods employed in archaeological popularization may also be successfully used in research on monuments of a more complex character[2].

Such an object is, undoubtedly, a drawing reconstruction of the Laurentine Villa of Pliny the Younger made by at least three skilful artists in the 1870s, commissioned by Stanisław K. Potocki and produced according to his instructions. At present, more than 30 priceless cardboards are kept in the National Library in Warsaw; they constitute an almost complete architectural design of the villa itself as well as its surrounding garden located in a larger spatial layout. The designs with two precise scales, several sections of the mass of the building as well as of particular rooms allow us today to realize the Enlightenment scholarly vision on a virtual construction site. So complementary in its form (i.e. architectural designs, projections of facades and walls of rooms, details of mural decorations, floors, and vaults as well as elements of furnishings) as erudite in its content (excellent quality adaptations of Roman works of art), the outstanding recording of Potocki's vision didn't appear in print at that time, it seems as if it waited for the right form of presentation. Only a virtual visualization of the villa design, supported by in-depth iconographical study, allows for full recognition of greatness and weight of this unique undertaking, which derived from the very spirit of Enlightenment. And so, the work on a modern, 3D presentation of the project started in the summer 2005.

Working method

1. Digitalization[3]

Considering the desired quality of digital documentation, which allows for the possibility of advanced intervention in files, the team decided to digitize the monument in the RAW format[4], which is often called a digital negative.

[1] A complete classification of applications of virtual worlds has been put forward by VELTMAN 2001.

[2] Preparing a 3D visualization of the imaginary world described by Francesco Colonna in *Hypnerotomachia Poliphili* (1499), was a breakthrough undertaking, which is little known to polish researchers. In 2002 a deluxe picture album, displaying views of sites and objects in the fantastic world created precisely according to original fifteenth-century prints and literary description, appeared under the imprint of the Franco Maria Ricci Publishing House. Such publications, which are not only (re)constructing past reality, but creating the very new after the literary source, are gaining increasing popularity. Cf. FOGLIATI, DUTTO 2002. The use of 3D visualization technology in research of the broadly conceived Humanities is likely to develop increasingly.

[3] The team wishes to thank Mr. Michał Dąbski, who had the photographs taken, for a cheerful and fruitful cooperation during the very first stage of work on our project.

[4] A raw image file contains minimally processed data from the image sensor of a digital camera or image scanner. Raw files are so named because they are not yet processed and ready to use by a bitmap graphics editor, printed, or displayed by a typical web browser. The image must be processed with special software designed for the particular implementation of raw used by the camera before it can be manipulated. The contents of raw files are often considered to be of higher quality than the RGB converted results.

A Nikon D50 6.1 Megapixel Digital SLR Camera with the whole set of lens was used to photograph each cardboard as a single frame and, apart from that, significant details from the decorations of walls and floors. The data were immediately downloaded into the hard drive of a portable computer where the photographs underwent initial evaluation and then were archived on a DVD-ROM.

2. CAD (Computer Aided Design)

Cardboards with drawing reconstruction already in a digital form were transferred to CAD software to prepare vector plans and projections being the basis for building a three-dimensional model of the mass of the villa and its surroundings[5]. At this stage of the work the historical scales (*palmi romani, braccia polacche*) were converted into the metric scale, which was chosen as binding on the whole project[6]. In this way, the 18th-century architect's drawings were transferred to the CAD software universally used in modern architectural offices.

3. Building a virtual model of the Villa

The 3D Studio MAX 8, which offers advanced possibilities of working on three-dimensional models and their visualization, was used in the work. The modelling of particular constitutive elements of the mass of the villa, rooms, and architectural components and details was started on the basis of vector plans and copied outlines imported from the CAD program.

At the present stage of the work the model of the mass of the villa[7] (**Fig. 1**) – sculptures and some minor details are to be added subsequently – and the first room – *unctorium* have already been completed. On account of the attention to detail and high fidelity of the visualization, which result in increasing the number of polygons in the scene[8], particular rooms are created in separate files (**Fig. 3**). At a further stage, they will be imported to the main file containing the model of the villa in order to generate advanced animation.

4. *Unctorium*

The visualization of this room (**Fig. 4**) required performing the following operations:

a. building a structural model of the room on the basis of a detailed plan and precisely placing it in the plan of the villa;

b. modelling particular architectural elements, i.e. capitals, cornices;

c. modelling elements of furnishings and artefacts, i.e. basins, perfume burners[9], pedestal, sculpture group of two naked youths[10] (**Fig. 2, 5**).

At the final stage specially prepared textures were applied on the models. Figural bas-reliefs above apsidal niches were produced on the basis of the drawing of decorations[11].

Rendering[12]

At this stage the key element seemed to be the choice of the renderer (specific software component), which was to be responsible for final converting of the given settings of the scene, just before the generating of the visualization. The Mental Ray renderer, which had appeared in the latest versions of the 3D Studio MAX, was chosen. This module allows for creating photo-realistic visualizations and because of its possibilities it has already been used in professional television and movie productions.

The most common error found in visualizations of historical interiors is incorrect lighting of the scene, produced using inappropriate light. Creators of virtual reconstructions often forget about the importance of colour temperature and intensity (it concerns the difference between the bulb light, sunlight, or flame of a candle). Research conducted by a team of scholars from the

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[5] BN WAF 67 inv. no. 4999-5005. At this stage, thanks to the special discipline of work imposed by the program it was possible to eliminate from the further research a few errors repeated in the literature of the subject, regarding the function and location of certain rooms in the plan of the whole layout.

[6] The total height of the basic element of the facade (the base + column + capital) is 6.3 m. Hence, the approximate height of the building is 20 m.

[7] A preview of that model was presented for the first time at the annual conference of the Institute of Archaeology at Warsaw University in December 2005.

[8] Every element of virtual 3D scene consists of a certain number

of complex polygonal objects. The more detailed is the model, the bigger is the number of polygons.

[9] BN WAF 67 inv. no. 5011, WAF inv. no. 5034.

[10] The sculptures were modeled independently using the Poser 6 program.

[11] The bump map technique was used, as there was no need to create separate models.

[12] Rendering is the process of generating an image from a model, by means of a software program. The model is a description of three-dimensional objects in a strictly defined language or data structure. It would contain geometry, viewpoint, texture and lighting information.

University of Bristol revealed considerable differences in the appearance of visualizations of a room decorated with wall paintings under different lighting conditions[13].

Basing on the British team's findings, we decided to place emphasis on adjusting the settings which would consequently simulate the natural sun lighting. With this aim in view we used the so-called *Sunlight System*, which, apart from choosing light settings, allows for determining geographical coordinates and entering a date and time, which makes it possible to realistically simulate the natural movement of the sun over the horizon in a given place on the earth. In the context of the visualization of the Villa of Pliny it had fundamental importance since the cardboard, on which we can see the whole layout, is affixed with the wind rose. Thanks to this we have the possibility to adjust the lighting of rooms, characteristic of the subtropical zone at different times of the year and day.

Aims

At the present it is planned to provide the model of the mass of the villa with architectural details, to form particular rooms with furnishings and sculptural decoration, to create digital mural decorations (textures, bump maps) and to model the immediate surrounding of the villa, including garden pavilions and the flora described in Pliny's letter to Gallus. The intended effect is also to transfer the project created under the patronage of Count Potocki to the virtual world *par excellence*. Therefore, we plan to generate the animation allowing both for a visit to the villa as well as a walk around its surrounding garden. Because of technical reasons the first test animations are created in the presently imposed PAL television format. The final version of animation will be generated in the HDTV format, which will be a big jump in quality.

Bibliography

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[13] DEVLIN, CHALMERS 2001. A computer simulation made it possible to show how mural decorations of a rich room in the House of the Vettii at Pompeii decorated with frescoes (oecus or reception room) looked like under natural lighting conditions (i.e. olive oil lamps).

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Realistic visualization of Count Potocki's Laurentine Villa.
Progress of the works

Summary

Over the last years new technologies have opened up countless opportunities for the world of science and *building virtual (digital) worlds* is one of most interesting among them. Methods employed in archaeological popularization may also be successfully used in research on monuments of a more complex character.

Such an object is, undoubtedly, a drawing reconstruction of the Laurentine Villa of Pliny the Younger made by at least three skilful artists in the 1870s, commissioned by Stanisław K. Potocki and produced according to his instructions.

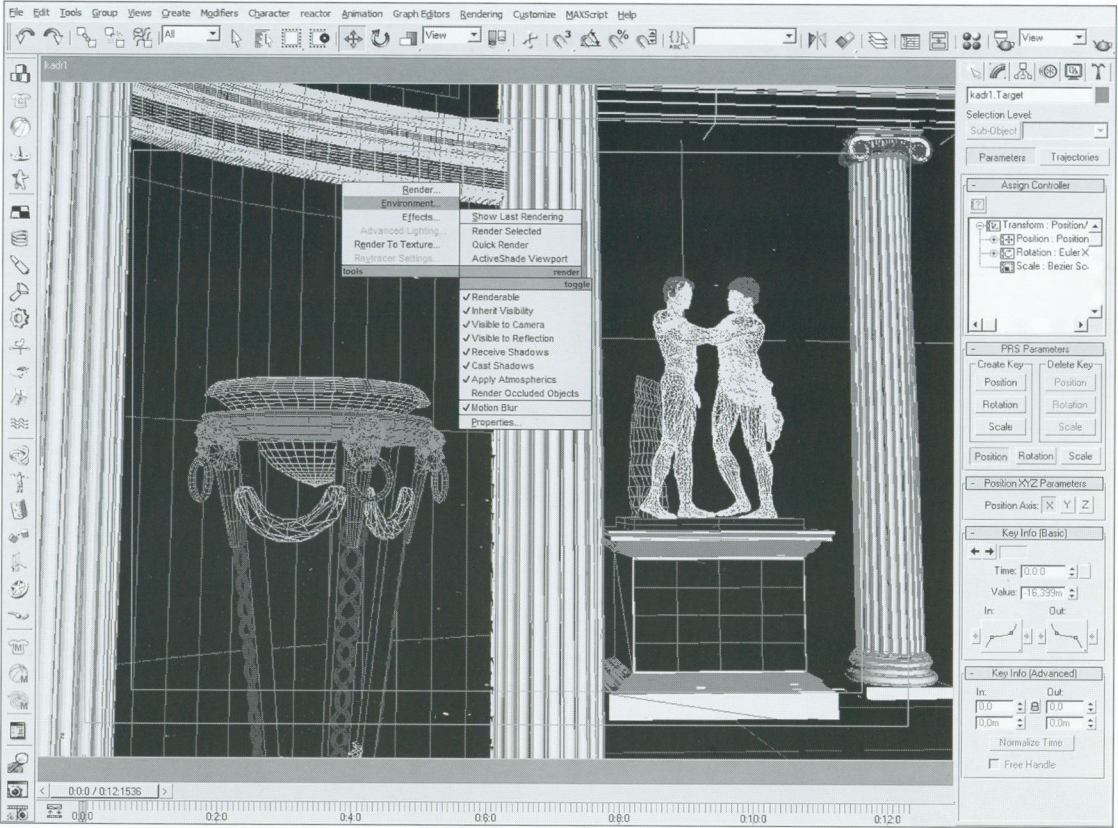Fig. 1. Preliminary seaside view of the mass of the villa

PLATE 45

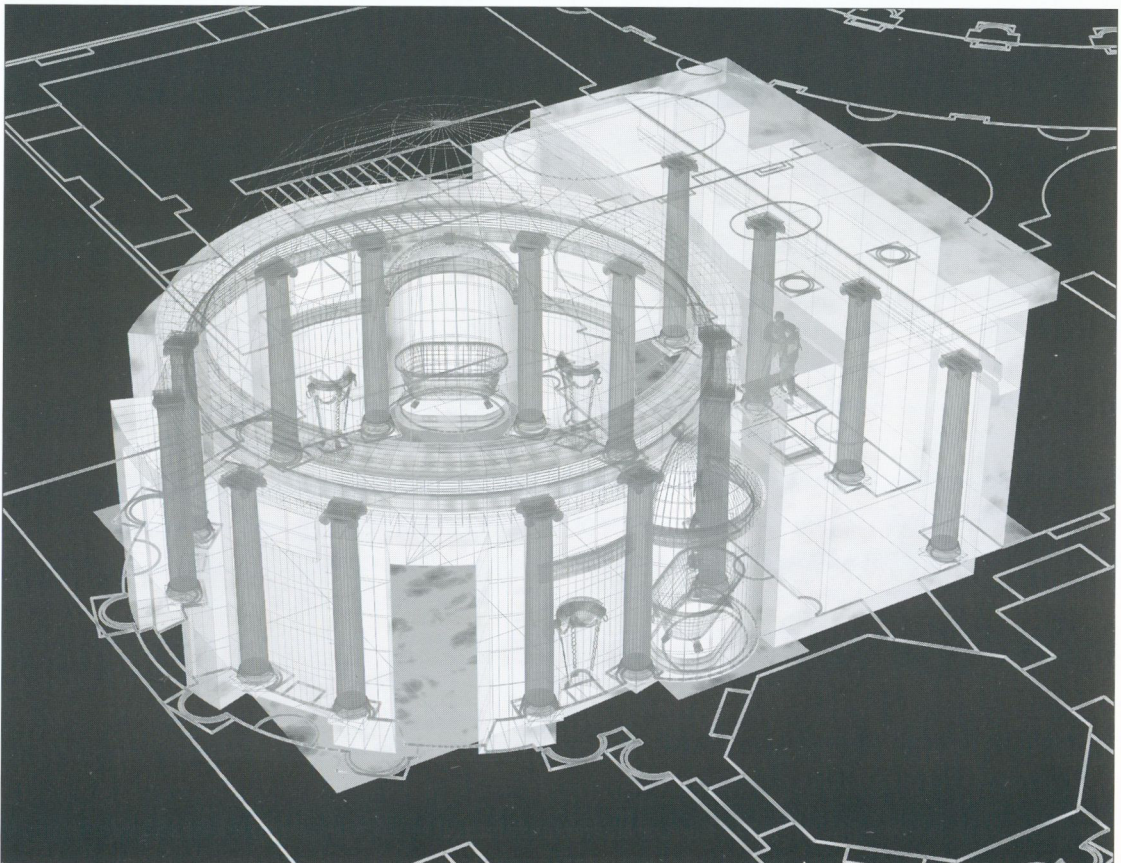Fig. 2. The work on the model in 3D Studio MAX

Fig. 3. *Unctorium* – model used in the visualization scene

PLATE 46

Fig. 4. The detailed view of the *unctorium* perfume burner and the sculpture group in the corridor

PLATE 47

Fig. 5. The general view of the *unctorium*