THE PROCESS OF MAKING 3D VECTOR SCENOGRAPH OF ANCIENT BUILDING WITH LARGE QUANTITIES OF DATA

ZHU Yixuan
CHEN Zhiyong

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ABSTRACT This paper introduces the process of making 3D vector scenograph of an ancient building with large quantities of data with the aid of AutoCAD, which displays the effect of scenery drawings. The vital skills and technique involved are illustrated through the example of Pagoda of Thousands of Buddha in Chi Lin Nunnery in Hong Kong. This construction was started in 1996 and finished in 1999 with the concrete structure internal and wood external, imitating the style of buildings in Tang Dynasty. Thus, 3D vector scenograph become available to users.

1 Introduction

Ancient buildings, as the essence of ancient Chinese culture, characterized by its complex and antique shape, delicate structure, compact combination and graceful sculpture, are appreciated globally. Some ancient buildings made of wood endure long because of its solid structure. For example, the existing Nanchan Temple and Foguang Temple on Wutai Mountain in Shanxi Province of China can be traced back to Tang Dynasty. Nowadays, the building techniques have been constantly renovated due to the integration of both old and new ones. Before computer coming out, the available drawings and internal structure drawings were all made by hand. The scenery effect of the building perceived by human eyes was demonstrated in the drawings made by building artist. The popularity of the technology of CAD provides sufficient hardware and software environment for making 3D scenery effect drawings of shape and internal structure drawings. With the aid of computer technology the delicacy and meticulousness of ancient buildings have been represented accurately and perfectly, and the abstract technology has been simplified.

2 Making process

The process of making a 3D scenograph has the following steps. Collection of original data → Making separate parts of the building → Combination of part structure drawings → Combination of the whole building → Creating 3D scenograph.

2.1 Collection of original data

There are four methods of collection under different practical conditions.

1) On the practical measure. The original data of the Pagoda of Thousands of Buddha is obtained by measuring the actual parts of the building.

2) Making 3D drawings based on plane figure. Under the condition that no processed actual part has been made, the 2D data can be transformed into 3D data according to the design drawings.

3) Obtaining 3D data of parts with complex surface by converting the results from PhotoModeler into AutoCAD.
4) Making of 3D according to designs directly in case without plane figure.

2.2 Making drawings of separate parts of the building

The establishment of 3D models starts from the individual part reasonably in response to the property of ancient buildings that the whole body is occluded compactly through rabbets and mortises of each single part.

A closed and independent 3D drawing including its shape, direction and size is totally consistent with its equivalent, the actual object, and reflects each model of the part, as shown in Fig. 1, which is the 3D drawing of Dou and Gong.

![Fig. 1 Separate part](image1)

2.3 Combination of a floor

In view of the fact that the wood ancient building is combined through rabbets and mortises of many sub-parts, it is usually divided into Columns, DouGong Layer, Roof Frame, Eave Layer and Tile. The simulating process manipulated by AutoCAD must follow the principle of compact combination. Only in this way can the drawings reflect the exterior appearance and internal structure truly. After the 3D drawings of each part have been made, computers begin the organization layer by layer. Fig. 2 shows the organization of part of the DouGong; Fig. 3 shows the organization of the whole body of DouGong; Fig. 4 shows the organization of the floor 1.

2.4 Combination of the whole building

The Pagoda consists of 7 floors. After the combination of each floor has finished, AutoCAD begins the combination of the model of the whole building.

![Fig. 2 Part of DouGong Fig. 3 Whole body of DouGong](image2)

2.5 Creating 3D vector scenograph

The above stated process from making drawings of parts, combination of parts, combination of floors to combination of the whole is based on 3-axis reference frame namely Cartesian System. The problem with 3-axis reference frame is that when the vision point is changed, the 3D model can only be rotated around the paralleling axis (see Figs. 5 and 6). Obviously, Fig. 7 shows that the drawing made from orthograph is inconsistent with the sights perceived by human eye. Hence, it is hard to result the overall effect of the design of the building. To achieve the similar effect of 3D-scenery sight perceived by human, it is necessary to convert Cartesian System to Central Projection System. This conversion involves several procedures in the process for imitating photographing in AutoCAD.

2.5.1 Choice of zoom

The choice of zoom depends on the practical requirements and it determines the view angle. The short zoom should be chosen when the model has to be observed a short distance through wide view angle. By contrast, the long zoom is preferred when the model is to be observed in a farther distance through narrow view angle. Therefore, the short zoom is preferable to the long one when the graph is intended to display primarily the grander and height of the building, and vice versa.

2.5.2 Choice of camera distance

Fig. 8 shows the theory of scenograph; camera can be calculated when zoom has been chosen.

2.5.3 Choice of view line

In the process of modeling photographing to make perspective drawings with AutoCAD, the proper vision point and the view line is determined by the location of the parts to be observed. The down view is proper for observation of the shape of tile, while the up view is proper for the observation of the