Research on Application of Computer 3D Modeling Technology in Ceramic Tea Set Design

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Abstract. In this paper, the concept of computer modeling technology is first analyzed, and then several common instruction commands in computer 3D modeling are expounded. Finally, the application of advanced and basic modeling techniques in ceramic tea set design is analyzed in depth, including detailed discussion and planning on lofting modeling, turning modeling and extrusion modeling. Based on the present situation of ceramic tea set design in China, computer 3D modeling technology is introduced into it, which makes the ceramic tea set design perfect in the development.

1. Introduction
In recent years, network technology has developed rapidly, among which Internet, computer, big data and other network technologies are mature and have been applied in the development of all walks of life. With the wide application of computer technology, the model data information changes rapidly, which hinders the development of ceramic tea set design. To solve the above problems, more and more ceramic tea set design industries apply computer 3D modeling technology, which can not only stimulate designers' creative inspiration, but also help designers build tea set models quickly.

2. Concept of Computer 3D Modeling Technology
The process of reconstructing scenes or three-dimensional objects in real life through three-dimensional data and then realizing the reconstruction results on a computer is called computer three-dimensional modeling technology. Geometric modeling, feature modeling and surface modeling are several major categories of computer 3D modeling technology, which are more common in real life, such as making ceramics and carving. Computer 3D modeling technology needs related software to assist in its application. 3DX MAX is a more comprehensive modeling software developed in China at present. Compared with other modeling software, 3dxmax is different in that there are many modeling methods in the system, and relevant designers can complete the design of related products through their own geometric models in the system, or build their own models through their own innovation capacity[1]. It is one of the advantages of 3DX MAX software to be able to construct the model from two-dimensional or three-dimensional angles and express the points through the rectangular coordinate system in mathematics. Two-dimensional plane construction is completed by using a style curve and drawing board, and then the related data information is modified and perfected in the panel, which is the concrete construction mode of 3DX MAX, and then the two-dimensional model is converted into a three-dimensional model by physical means such as rotation and lofting. Figure 1 is the approximate model of tea set built quickly by 3DX MAX. Building a model directly from three-dimensional space is called building an advanced model. In the process of building, mathematical
knowledge such as coordinate system is often used to mark data information, and then the threedimensional model is built through curved surface, plane and lattice diagram. Before using 3DX MAX modeling software to complete the design of ceramic tea set, it is often necessary to do more preparatory work, such as which parts the whole ceramic tea set model is composed of, the composition structure of tea body, teapot, tea cover and teacup, and also need to know the types of tea set. There are many models of tea set, and many similar models can be created by using computer 3D modeling technology. At last, when using 3DX MAX software to create the model, the designer should complete the construction of the three-dimensional model one by one according to the process of setting the goal, building the model quickly, carving the middle mold and the high mold, baking the low mold and making the low mold[2].

![Figure 1. The approximate scale model of tea set based on 3DX MAX](image)

3. **Several Common Auxiliary Commands in Computer 3D modeling**

3.1. **ZBRUSH map**

ZBRUSH map includes bump map, normal map and displacement map, among which bump map is widely used in ceramic tea set design. Using bump mapping to complete the model construction is often based on materials, which are set as three-dimensional models, then perfected by imitating rough surface technology, and finally rendered by light; Because of the light and shade effect, the designer understands the plane as a solid, but the ordinary bump mapping records the bump value in one direction according to the gray value. Once the vision changes, it will look like a simple plane with a pattern, so the designer's vision plays an important role in bump mapping. Bump mapping is generally used to finish the carving of ceramic tea set style. When using bump mapping to finish the carving, we should first design the decorative patterns of ceramic tea set with relevant colors, and finally show different bump effects according to different colors of images. For example, designers can set the signs of depression and protrusion according to their own color preferences, such as blue for depression and red for protrusion; Finally, relevant operators can complete the modification and improvement of real-time data information by issuing relevant instructions[3].
3.2. Boolean Algebra
Boolean algebra are mainly aimed at objects in the application process, which can perform set operations on two objects. Intersection, cutting and union are the types of Boolean algebra, and Boolean algebra play an important role in the construction of three-dimensional space and two-dimensional plane. The modeling of objects constructed by Boolean operation is mainly completed by integrating the union and intersection of two relatively closed modeling. In addition, Boolean operations should follow the principles of more and less intersection, first intersection and then union. Intersection and difference sets have a great influence on the integrity of image surface fundamentally, but union sets have little influence on the surface of graphics. Therefore, in the process of building the model, in order to avoid the phenomenon of incomplete image surface, the designer must put the intersection work in the first step. After copying the object, it may be necessary to evaluate the intersection and difference set continuously, which greatly reduces the use of labor; According to the investigation, when difference sets and intersections are used in model construction, the integrity of the graphics surface may be destroyed. Therefore, in the later stage of model construction, the use of difference sets and intersections should be reduced.

4. Analysis of Applying Advanced and Basic Modeling Techniques in Ceramic Tea Set Design

4.1. Polygon Modeling Technology
NURBS modeling technology, plane modeling technology and polygon modeling technology are three advanced modeling technologies in 3DX MAX modeling software, among which polygon modeling technology is widely used in people's life, especially in the design of ceramic tea set, because of its easy understanding and distinct hierarchy in modeling, and it can also provide designers with a simple way to repair data. Editing grid and editable polygon are two major instruction commands that polygon modeling technology mainly relies on in the application of ceramic tea set design. The operation methods of the two commands are essentially the same. Later, due to the rapid development of computer technology, polygon editing technology has made great progress, gradually surpassing grid editing and becoming the most widely used instruction command in polygon modeling. Entity modeling technology is another name of polygon modeling technology. There are two design ideas in the design of ceramic tea set. The first idea of applying polygon modeling technology in the design of ceramic tea set is to transform complex object shape into simpler object shape and then polish and repair it. The other method is the same as carving and polishing, which transforms two-dimensional plane into three-dimensional space, then polishes and repairs the defective places, and finally finishes the carving work by polygon editing. The second idea can be applied to arbitrary geometric modeling, so it is widely used in polygon modeling technology. For example, when modeling a teapot polygon, it is necessary to set fewer edges and take collapse as an editable polygon. Then, by inserting and re-extruding some of the used faces on the teapot, and repeatedly modifying the extruded length, the extruded length value is finally obtained, so as to obtain an accurate teapot model of ceramic tea set. Figure 2 is a diagram of editing vertices in the process of making tea sets[4].
4.2. Lofting Modeling

Lofting modeling, turning modeling and extrusion modeling are three basic modeling techniques. Extrusion modeling is often suitable for three-dimensional objects whose cross-section is stretched in the same direction, but the cross-section shape will not change greatly, so there are limitations in the use process; Turning modeling is widely used in the construction of symmetrical modeling, and also in the design of ceramic tea sets, such as teapots and teacups. When using turning modeling to build a model, first draw the profile of the object and close the two-dimensional lines. In the construction process, the designer can use the curve designer to calculate and modify the relevant data, which makes the built ceramic tea set model richer. The above two modeling methods have certain limitations in nature, and lofting modeling is different from this, so it is applied more frequently in the design of ceramic tea sets. Lofting modeling technology mainly relies on two two-dimensional planes, and then through the cross-section of two-dimensional planes, finally get a three-dimensional model. In short, lofting modeling technology is to orderly arrange multiple two-dimensional planes to finally get a three-dimensional space model. For example, to build a teacup with a round cross section, we need to have a deeper understanding of lofting function, and then we need to area the cross section of the model, that is, to area the teacup. After the area, we can select the view-visual style-reality, and then we can see the rendered cross section. Then we click the lofting button and choose the graphic synthesis lofting to complete the design of the teacup shape[5]. In addition, the designer can specify and select the cross-section and build the model according to the path. This method of building the model can scale and modify the model through the curve designer. The application of this method will make the built model more diversified and innovative, which plays an important role in the development of ceramic tea set design.

5. Conclusion

The rapid development and application of network technology has brought great changes to people's lives. Computer network technology has been introduced into all walks of life, especially in the field of ceramic tea set design. The design of ceramic tea set itself has many shapes, and with the rapid development of the network age, designers can not quickly understand the emergence of real-time modeling. The application of computer three-dimensional modeling technology in ceramic tea set design solves the above problems. Computer three-dimensional modeling technology can obtain relevant real-time modeling data, which provides more for designers in building models.
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