



Research on Design and Application of Customized Furniture Based on Computer 3D Modeling Technology

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Abstract. Through the elaboration of the application status of computer 3D modeling technology and the discussion of the development trend of customized furniture industry, the computer 3D modeling technology is applied to the design link of customized furniture, and the relevant design practice is carried out through rhino software, so as to optimize the design quality and efficiency of customized furniture and make it more in line with the design objectives. So as to reduce the increase of time cost and economic cost caused by design deviation, and realize the high-quality, high-efficiency and large-scale production of customized furniture.

Keywords: 3D Modeling Technology · Customized Furniture · Design Practice · Design Efficiency

1 Introduction

With the development of customized furniture industry, the demand for customized furniture increases rapidly. Facing the highly competitive customized furniture market, computer 3D modeling technology provides an efficient design method for customized furniture. Using computer technology to make drawings more clearly and standardized, improve the quality of customized furniture and shorten the design cycle through the accuracy of drawings. In the era of 5G, the concept of “industry 4” and “Internet plus” were put forward, and more and more furniture enterprises started the construction of information and intelligent engineering. Intelligent engineering is a technology suitable for industrial decision automation, and design is a complex analysis, synthesis and decision-making activity. Therefore, it can be considered that intelligent design is the result of the application of decision automation technology and intelligent engineering in the design field [5]. In particular, customized furniture realizes the integration of production and design through 3D modeling technology and automatic manufacturing technology, so as to reduce the cost loss in the process, reduce the design cycle and enhance the market competitiveness of enterprises. Therefore, starting from the computer 3D modeling technology, combined with the current situation and concept of customized furniture, and the design and applmore convenient and fast, and provides an effective reference for the design of customized furniture.ication of customized furniture through rhino modeling tool, it makes the design of customized furniture.

2 Application of Computer 3D Modeling Technology

There are many kinds of 3D modeling technology tool software, the most commonly used are AutoCAD, 3DMAX, rhino, and other software. AutoCAD's modification of curves is not as good as 3DMAX and rhino. In 3D modeling, the shape changes greatly due to many irregular curves. In particular, in order to meet the preferences of different consumers, the shape and contour of customized furniture change greatly. Rhino is recommended for modeling, and customized furniture is designed through two modeling methods. One is to design the shape of furniture, and the internal structure is relatively simple. This modeling method only needs to show the shape of customized furniture. It is characterized by simple operation and easy to check the effect drawing of the overall shape, but there is no detailed construction drawing. The other is to decompose the furniture model structure for modeling, and finally assemble the components to obtain a complete furniture model. This modeling method has high precision and can export the construction drawings, internal structure drawings and perspective drawings of various components, but the operation is complex and the modeling speed is slow. In addition to the above features, rhino modeling software has good compatibility with other software. After rhino modeling, keyshot can be used to render the model, which has the advantages of fast drawing speed and high image quality. In addition, rhino can also be associated with subsequent manufacturing links. Output format file, import the format file into the 3D printer, generate machining code, and quickly print the virtual model. Therefore, 3D modeling technology is favored by furniture design masters [4].

3 General Development Trend of Customized Furniture Industry

With the coming of the 5G era, the Internet plus technology is combined with the traditional design industry. Through the transmission and summing of data information, furniture design and manufacturing enterprises are guided to achieve the design with direction, high efficiency and high yield, so as to reduce the manual production cost of the workshop and multi machine "intelligent manufacturing". As a labor-intensive traditional manufacturing industry, customized furniture has always made customized furniture more targeted and directional through intelligent manufacturing methods such as Internet, big data and digitization. Based on this, the traditional custom furniture design and manufacturing mode is reconstructed, transformed and upgraded [1].

Customized furniture is the embodiment of customers; increasingly diversified life style and personalization. The traditional customized furniture model cannot meet the needs of the customized market. The production mode and marketing mode of customized furniture are also changing, from customized furniture to whole house customization, from integrated home to smart home; From the small workshop stage of manual production to the large-scale automation of data controlled production, intelligent manufacturing methods such as digital design and modular production play an important role in the transformation of customized home industry [2]. In the context of 5g era, with the interconnection of all things as the main feature, through big data resources and informatization as the core competitiveness of enterprises, customized furniture can better meet the material and spiritual needs of consumers. And reduce the

cost of enterprises in design, production, sales, logistics and other links. Realize the concept of “five in one” industrial system development of customized furniture industry with intelligent manufacturing as the core, including personalized design, intelligent production, rapid logistics, intelligent products and networked sales [7].

4 Current Situation and Design Concept of Customized Furniture Industry

At present, there are many customized furniture brands in China, and the market competition pressure is great. The customized furniture industry has changed from single type of customized furniture to whole house customization. The design and manufacturing process of customized furniture is as follows: first, customers understand the details and quality of relevant products from stores or publicity; Second, the designer comes to the door to measure the size, understand the customers needs and put forward the corresponding scheme; Third, use 3D modeling software to model the product, render the product model through rendering software, and output furniture renderings; Fourth, negotiate with customers for details and confirm the product material type, texture, color and relevant accessories. Fifth, calculate the project amount, reach an agreement with the customer, pay the deposit and sign the contract; Sixth, confirm the final house type and furniture size, and send the finalized drawings to the factory for parts processing; Seventh, when the product is delivered to the customer’s home, the master will install it on site and pay the balance [8].

Customized furniture has the following characteristics: first, low cost. Customized furniture enterprises use modular and standardized design system and flexible production to reduce costs. Decompose customized furniture, split and reorganize multiple orders in the production process, make maximum use of raw materials while ensuring product quality, reduce unnecessary waste, improve production efficiency and realize low-cost manufacturing through serialization, generalization, combination and modularization of product parts. Second, high quality. Because customized furniture is split and reorganized after modular production of parts, modern and intelligent mechanical arms, power rollers, buffer racks and other equipment are mostly used in production enterprises to realize high efficiency, high precision and high quality of parts. Hardware and accessories are mostly imported products with guaranteed quality. Third, the production cycle is short. The designer connects the software with the factory production system to intelligently distribute the design scheme to nearby factories. The factory splits the parts according to the order, retrieves the corresponding part code, enters the corresponding processing program, and shortens the production cycle.

5 Production Process of Customized Furniture Based on Computer Technology

Take a panel custom furniture enterprise as an example, as shown in Fig. 1, which began to upgrade its information management in 2015. Build the sales end through the ERP (Enterprise Resource Planning Administration) management system, that is, the fully

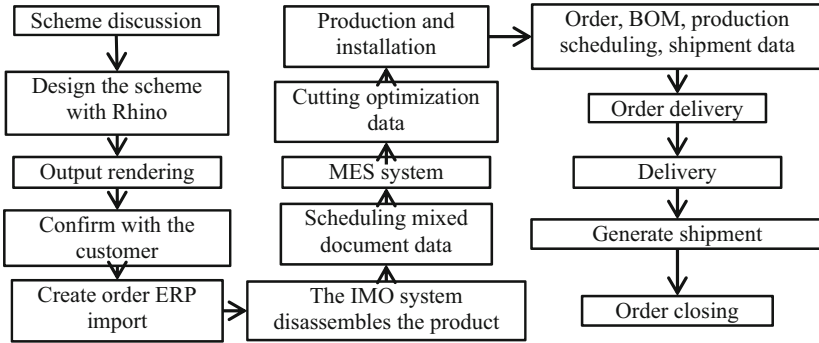


Fig. 1. Design and production flow chart and operation form.

networked “order management system”, [6] use the 3D modeling software to model the furniture and output the engineering drawings, and use the German IMO (IP multimedia operation system IP) system to disassemble the customized furniture parts, Output the part production number to “MES (Manufacturing Execution System Association) flexible intelligent control technology system” for part manufacturing and installation; The financial department adopts “electronic article surveillance (EAS) software”. Make the whole production process of the whole product realize the production management mode of group parts kneading production, two-dimensional code scanning and acquisition of boards in the whole process, full electronization of process documents and drawings, and full data of plan follow-up feedback statistics, so as to perfectly combine software and hardware and form a complete ERP information management system chain [9].

First of all, at the initial stage of the design stage, the designer communicates with the customer and measures the scale on site. At the same time, the designer introduces the brand, products and relevant reference cases to the customer, so as to promote the preliminary intention of cooperation. Door to door gauge is a key link in the customized design process and plays a decisive role in the transaction of customized business. Communicate with customers on site and record their needs, and record the initial parameters of house type, so as to provide basis for subsequent customized design. Secondly, 3D modeling is carried out through rhino, and the design results are visualized to confirm the final scheme [3]. The final scheme is rendered as a whole and the effect drawing is output, which is confirmed with the customer again. After confirmation, the customer pays the deposit. The designer imports the design drawings into the ERP system, splits the product parts through the IMO system, searches the corresponding part codes, and enters the corresponding processing procedures. Through the serialization, generalization, combination and modularization of product parts, the production efficiency is improved and low-cost manufacturing is realized.

6 Application of Computer 3D Modeling Technology in Customized Furniture Design

Taking the chair based on axis rotation as an example, this paper explores the application of rhino software in furniture design by using 3D modeling technology and three views.

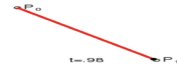
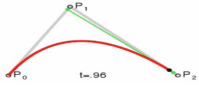
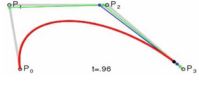
Curve order	Number of control points	Number of splines		Smoothness
First order Bezier curve	2	1	$B_{(t)} = (1-t) P_0 + tP_1, t \in [0,1]$	
Second order Bezier curve	3	1	$B(t) = (1-t)^2 P_0 + 2t (1-t) P_1 + t^2 P_2, t \in [0,1]$	
Third order Bezier curve	4	1	$B(t) = \begin{cases} P_i, k=0 \\ (1-t) P_1^{k-1} + tP_{1+1}^{k-1} \\ P_i, k=1,2,\dots,n, i=0,1,\dots,n-k \end{cases}$	

Fig. 2. Bezier curve control point analysis table

Start rhino software and analyze the model first. Due to the relative law of chair modeling, the surface is extruded with polygons and the axis rotation is taken as the chair surface. By adjusting the multilateral to adjust the details of the chair surface, so that the chair surface cannot only meet the use requirements, but also reflect the beauty of customized furniture. The support part of the chair is modeled by track lofting to form the shape of steel rotation and distortion, and the support part of the chair is finally obtained by rotating and cloning through the central axis column below the axis. In order to obtain a relatively smooth Bezier curve, the quantitative analysis of the number of control points is carried out, as shown in Fig. 2. The desired goal is achieved by adjusting the Bezier curve of the control points.

Therefore, the modeling sequence of “part first and then whole” is adopted. After the modeling of some parts is completed, the local parts are combined into a whole to customize the furniture modeling. After the model is made, as shown in Fig. 3, if the construction drawing is required, select the medium object, set the parameters and required drawing requirements in the menu bar, and generate the three views or assembly drawings of the product.

Take the bar table and chair as an example, as shown in Fig. 4, explore the application of rhino software in furniture design through 3D modeling and plan construction drawing. Open rhino software, set the required parameters, and analyze the model before modeling. Because the shape of this bar table and chair is relatively regular, it is a cubic stacking structure, and the overall shape is not complex, and the surface structure with large scale is not used in modeling. Therefore, the modeling sequence of whole first and then part is adopted. Use box as the modeling basis to create the top plate, panel and side plate of bar tables and chairs. After completion, use the surface fillet tool to fillet the

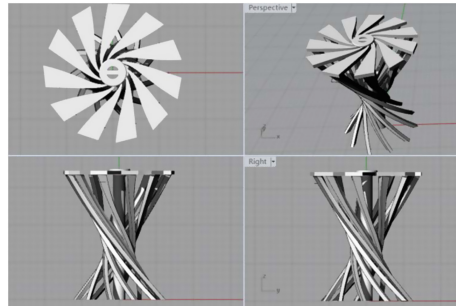


Fig. 3. Design and application of chair shape and structure through Rhino.

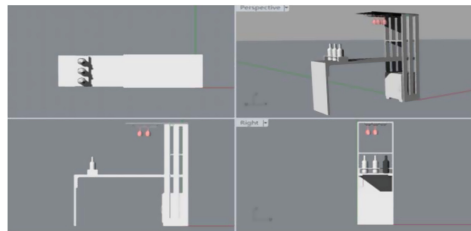


Fig. 4. Design and application of bar table and chair shape structure through Rhino.

edges and corners of the bar tables and chairs, making the customized furniture softer as a whole. When modeling the bar table and chair holes, box is also used as the base, and the bar holes are made by changing the size of box base and cooperating with Boolean operation, so as to achieve the production of holes with different sizes. The support part of the bar table uses the box base to make the section change of the support part with the Boolean operation difference set. Finally complete the model making.

7 Conclusion

Through the computer 3D modeling technology, the design method of customized furniture is optimized and improved, so that the customized furniture can visually present the designed finished products in the design process. Through the computer 3D modeling rhino software, the customized chair and bar are designed and studied, the modeling process is analyzed, and the modeling methods in different cases are classified. It provides a new idea of integrated design of design stage and manufacturing stage of computer modeling technology, applies computer technology to the design architecture, design process and design content of customized furniture, effectively improves the design quality and design efficiency, and provides a reference scheme for the realization of intelligent customized furniture manufacturing system in the next step, It plays a positive role in promoting the high-quality development of customized furniture industry.

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