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Application of data based on genetic algorithm and 3DMax in 3 D design of jewelry

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Abstract: This paper briefly analyzes the background of the 3 D jewelry design, and proposes a 3 D jewelry design scheme based on 3DMax and genetic algorithm. During the research, mainly in the jewelry 3 d design genetic algorithm and 3DMax the main application of ideas, at the same time from the jewelry sketch drawing, jewelry 3 d model construction, the details of the jewelry 3 d model optimization of the three main process steps as the breakthrough point, mainly expounds the jewelry 3 d design genetic algorithm and the specific application of 3DMax, better guarantee the actual jewelry 3 d design results meet the relevant requirements.language.

Key words: jewelry 3 D design; 3DMax; genetic algorithm

Introduction: In the original three-dimensional design of jewelry, it is easy to weaken the details, which finally promotes the lack of details in the three-dimensional design results of jewelry. In order to make up for this defect, 3DMax software and genetic algorithm can be integrated to build 3 D models of jewelry to improve the 3 D design effect of jewelry and better maintain the integrity of design details.

1. Background analysis of genetic algorithm and 3DMax in jewelry 3 D design

Jewelry designers in jewelry design, jewelry works of three-dimensional image constantly in my mind deduction, planning, adjustment, finally determine the jewelry design, but jewelry design display figure finally using the way of plane, with the concept of empty feeling, jewelry beauty display also exist insufficient, cannot better express the designer's design concept and ideas, reduce the viewing experience of people. Therefore, the use of three-dimensional display technology for jewelry design and display can fully display the details of jewelry and reflect the design sense and beauty of jewelry. In addition, the application of this technology can show the various parameters of jewelry design, and the parameters can be adjusted in real time, so as to reduce the difficulty and workload of designers.

Genetic algorithm is a search heuristic algorithm used to solve the optimization in the field of artificial intelligence in computer science. It is an evolutionary algorithm. This heuristic is used to generate useful solutions and promote the optimization of the solution content.3 DMax is a kind of 3 D design and operation software, which is used in jewelry design to improve the accuracy of data calculation. Moreover, the software has good effect rendering ability, better visualization degree, fast rendering speed, stable model rendering processing, and exquisite light sense. The combination of the two can improve the level of jewelry design, guarantee the artistry and integrity of the jewelry design results, improve the content of jewelry design, make the display effect of jewelry more three-dimensional, and improve the atmosphere and infection ability of jewelry design.

Applying 3D printing technology to the carved wax technology of jewelry is the innovation point of jewelry 3 d who. Traditional carved wax technology using artificial production way, not only time-consuming, and labor cost is extremely high, even craft skilled teacher, often also need three or four hours, and once appear operation error, you need to start all over again, and the application of 3D printing technology can greatly improve the manufacturing efficiency, reduce manufacturing costs, in order to achieve the effect of reducing the price of jewelry. The application of this technology works closely with the application of 3DMax software to provide technical support for jewelry design and manufacturing.

2. Analysis of the main applications of genetic algorithm and 3DMax in 3 D design of jewelry

Combined with the analysis of the current jewelry 3 d design practice, can understand is, with the support of 3 d design method, can promote the actual development time and research and development cycle presents a significantly shorter development trend, promote the whole jewelry design and the corresponding product development production efficiency improved, simplify the work steps and link. During the practice of implementing the modification of the original design drawings of jewelry, relying on the application of genetic algorithm and 3DMax, the basic drawings designed in the early stage can be directly obtained in the computer, and the whole process of jewelry design can be recorded by the computer system, so as to provide more convenient conditions for the development of the drawing modification work. For 3 DMax, the actual model building function is relatively powerful, introduced into the practice of 3 D design, the functional effect and function are more ideal, and the main process of 3 D design (Figure 1) is as follows: the design idea, input into the digital board; complete the drawing of jewelry design sketch, construct the 3 DMax model, integrate the attachment model, and the optimization of the model details; complete the whole 3 D design of the jewelry.

Referring to the above process to implement the 3 d design of jewelry. In the whole design practice, a variety of computer software and software supporting algorithms are applied to realize the optimization of the image processing. However, in this case, the actual completeness degree of the jewelry 3 D design results is likely to be not ideal, and the actual output 3 D design results of the jewelry and their corresponding models are of poor results. Based on this, in order to ensure the integrity of the jewelry 3 d

design results and the output model, improve jewelry 3 d design, in this study, the application of 3DMax software complete jewelry 3 d model construction, also further introduced the genetic algorithm for the corresponding jewelry 3 d model detail optimization processing, so as to ensure the actual jewelry 3 d design results meet the relevant requirements.

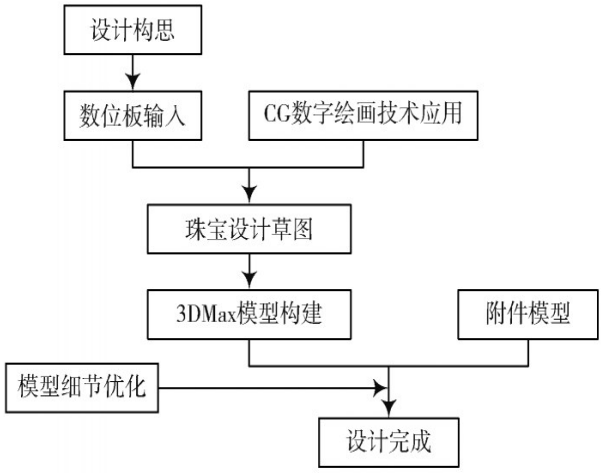

Figure 1 Main flow diagram of 3 D jewelry design

3. Analysis of the specific application process of the genetic algorithm and 3DMax in the 3 D design of jewelry

3.1 Jewelry sketch drawing

Jewelry sketch drawing is usually using hand-painted show way, as the basis of the subsequent jewelry design perfect, hand-painted process shows the change, the designer in the process of thinking and creative jewelry designer hand painting, using text instructions to the form of jewelry parts, material, color, or adopt the way of coloured drawing or pattern, make jewelry design sketch more vivid, show the different levels of jewelry. For the jewelry sketch to be more three-dimensional, Designers use CG digital painting technology to design the jewelry, The technology has a low cost of consumables; Production, modification, preservation, transportation and display are relatively simple; Advantages such as it can be displayed directly on the network, Designers store the drawn sketches as two-dimensional images, Processing of the image data by using the PS software, Clear the color level and color level, Display each metal with its corresponding color, Clarify the structure of the jewelry design, Then save the image in the DWC format, This format can upload the data of jewelry design to the 3DMax software, Provide the foundation for the construction of the next three-dimensional model of jewelry. In addition, two-dimensional images also need to have a strong appeal to convey the design ideas, ideas, and emotions to people, so as to ensure that the construction of three-dimensional models can make the expression of these emotions more vivid and improve the work value of jewelry design.

In the process of using CG digital painting technology to design jewelry sketches and improve various data, designers need to ensure the connection and alignment of each point, surface and line, ensure the accuracy of the design source, and ensure the perfection and accuracy of the elements in the jewelry sketch. The construction of three-dimensional model is to stretch, modify and squeeze the data in the sketch. Therefore, the quality of the sketch has a huge impact on the progress of the subsequent work, and at the same time, it has high requirements on the ability of designers. For designers in the use of CG digital drawing technology sketch design, avoid too much reliance on computer technology, and ignore the painting basic practice, to ensure that the manual sketch training, exercise their own design analysis, thinking and creative ability, don't fall into attention to "production technology", and ignore the "painting foundation" in this case, improve the efficiency of the design of the overall process of jewelry. Designers need to make rational use of CG digital painting techniques, Combining hand-painting with the training of the technique, Improve the understanding and training of deliberate sketches and random sketches, In a deliberate sketch, Pay attention to the picture effects, Rather than the design effects, Show off your own good ideas, And make sure that the producer can actually make it, Avoid the sketch is too unconstrained to let the master understand; In the random sketch, You can reflect your ideas, Document the process of the design, Random sketch can gather a lot of inspiration for designers, Integrating these sketches, To do "deliberate sketches" or computer graphics, The designer's creativity is gradually turned into a reality.

3.2 Construction of the three-dimensional model of jewelry

After completing the drawing of jewelry design sketch, it is necessary to further implement the construction of jewelry 3 D model. In practice, the processed jewelry design sketches are quickly imported into the 3DMax software. Because such sketches mainly exist and appear in the form of two-dimensional images, it is necessary to accurately control the height of the jewelry during the actual three-dimensional modeling. In this process, Lidal point cloud data can be introduced to estimate the height of the corresponding finished product after the jewelry design is completed. Referring to the characteristics of jewelry to implement the texture production, so as to ensure that the design and output of the three-dimensional model of jewelry can be more authentic. At the same time, in order to better realize the orderly maintenance of the construction of jewelry 3 D model, we should implement the reasonable design and control of the modeling process, mainly: the color setting, realize the output of jewelry pictures with the support of PS software processing; determine the jewelry vector data, conduct modeling in 3DMax software, combined with 3DMax model and jewelry pictures, comprehensive modeling and model surface mapping, and finally output the 3 D jewelry model.

In the practice of building jewelry 3 d model, need to set the base outline to complete the jewelry design sketch, and in the 3DMax software import the base outline, reset coordinates, in order to avoid during the actual jewelry 3 d modeling by error of image movement problems, eventually lead to coordinate change. In the 3DMax software, the base outline needs to be constructed in a 1:1 ratio, with the appropriate custom unit design set, and the size of the image unit meets the jewelry design set, so that the 3 D model of jewelry built can be directly imported into the database in the same proportion. At the same time, during the actual construction of jewelry 3 D model, the accurate calculation of the elevation of jewelry 3 D model should be implemented. In order to achieve this goal, it is necessary to implement grouping processing for the images of the same height after completing the preparation before

the modeling, and apply the extrusion and stretching function contained in the 3DMax software, combined with the height proportion calculated by the Lidar point cloud data, to realize the reasonable setting of the height of the three-dimensional model of jewelry. Referring to the coloring results of the jewelry design sketch, we use the PS software to intercept the more real texture images, and extract the color and texture parts contained in them. On this basis, apply the magic wand tool included in the PS software with reverse selection, using *. The form of Tga is saved for the acquired image. On this basis, it is necessary to further apply the mapping method to build the 3 d model of jewelry, and refer to the texture image, to achieve a reasonable control of the 3 D model details of the architectural treasure. During the actual mapping period, it is required to focus on the effective control of the texture direction, and to accurately eliminate some obvious texture errors, so as to ensure that the actual three-dimensional model of jewelry has a more ideal accuracy. It should be noted that the three-dimensional model of the jewelry constructed through the above process is likely to have a certain error with the original design drawing. Based on this situation, in order to ensure that the 3 d design of jewelry has a more ideal degree of integrity, it is necessary to further expand the detailed optimization processing of the corresponding jewelry 3 D model.

3.3 Detailed optimization of the 3 d jewelry model

In the early stage of the operation practice, the main application of 3DMax software and electronic drawing technology, realize the design and construction of jewelry 3 d model, and in order to further ensure the output of jewelry 3 d model and design has a stronger consistency between the original image, you need to continue the use of genetic algorithm to carry out the details of the corresponding jewelry 3 d dimensional model optimization. Set the error value of the jewelry 3 D model in the X axis direction is xt; the error value in the Y axis direction is ayt; azt in the Z axis direction, then:

$$\begin{cases} axt = \sqrt{a^2 x_s + a^2{}_y \sin\theta + a^2{}_x \cos^2\theta} \\ ayt = \sqrt{a^2 y_s + a^2{}_y \cos\theta + a^2{}_x \sin^2\theta} \\ azt = \pm\sqrt{a^2 z_s + a^2 z} \end{cases}$$

In the above formula, the resolution error of the jewelry 3 D model in the X-axis direction is ax, and ay in the Y-axis direction, and the Z-axis direction is az; and the photography center error of the jewelry 3 D model in the X-axis direction is A2xst, The center error in the Y-axis direction is a2yst, The center error in the Z axis direction is a2zst; The image rotation angle is set at θ. Combined with the application of the above formula, it can obtain the error of the 3 D model of jewelry, and the application of genetic algorithm to correct the error of the jewelry, there are:

$$\begin{cases} \Delta = a - b \\ c = \Delta/(a+b) \end{cases}$$

In the above equation, the absolute error of the jewelry 3 d model is Δ; the calculated value is a; the sketch value is b; and the relative error of the jewelry 3 d model is c. Combined with the application of the above formula, the relative error in the 3 D jewelry model of jewelry can be reduced to the minimum level, and the consistency between the length and width of the 3 D jewelry model and the corresponding data in the design sketch can be effectively maintained. Since the elevation is the parameter that needs to be focused on during the 3 d design of jewelry, we should focus on the determination and optimization of the error implementation of the parameter, namely:

$$\begin{cases} e = H_A - H_B \\ F = \dfrac{m}{\sqrt{n}} = \pm\sqrt{\dfrac{[e]}{n(n-1)}} \end{cases}$$

In the above equation, the true error of the jewelry 3 D model is e; the elevation of the jewelry 3 D model is HA; The elevation of the jewelry design sketch is HB; The number of calculations is m; the measurement error is n. The above calculation realizes the optimization of the elevation error of 3 D model, and the whole process optimization of the data error of 3 D model of jewelry. It is necessary to strengthen the maintenance of the authenticity of the texture in the three-dimensional model of jewelry, and reduce the amount of data as far as possible under the condition that the texture is true and clear. In addition, the PS software can be applied to implement the deformation processing of the texture, and effectively refer to the different implementation of the light to effectively adjust the tone and brightness, so as to complete the three-dimensional design of jewelry.

Conclusion: To sum up, in the actual 3 D design of jewelry, if the 3DMax software is simply used to produce the actual 3 D design results which is not ideal, and the actual 3 D design results of jewelry and their corresponding models are poor. Based on this, in order to ensure that the integrity of the jewelry 3 d design results and the output model, improve jewelry 3 d design, to the application of 3DMax software on jewelry 3 d model construction, relying on the use of genetic algorithm for the implementation of the corresponding jewelry 3 d model detail optimization processing, so as to ensure the actual jewelry 3 d design results conform to the relevant requirements.

References

[1] Li Mengnan. Study on the relationship between C2M and 3D printing in jewelry manufacturing [D]. China University of Geosciences (Beijing), 2021.

[2] Yuan Mingjie, Wang Liang. Innovative design of jewelry products based on 3D printing technology [A]. Dalian Polytechnic University. Proceedings of the Second International Symposium on Bionic Design and Science and Technology [C]. Dalian Polytechnic University: School of Art and Design, 2021:274-278.

[3] Zhao Bo. Innovation of jewelry design thinking: the transformation from plane to three-dimensional [J]. Chinese Baoyu, 2020, (03): 62-66 + 92.

[4] Chen Jiao. Based on genetic algorithm and 3DMax in 3 D design of jewelry [J]. Modern Electronic Technology, 2020,43 (07): 114-117.