Research on 3D Animation Processing Technology in Modern Art Design System

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Abstract—This article analyzes the expressiveness of 3D animation processing technology in terms of lens, character movement, light and shadow, detail shaping, visual special effects, and traditional elements. This paper studies the key points of technical application such as logical structure establishment, 3D animation modeling, animation model texture rendering, and dynamic interactive processing. The author sorted out the test environment, animation modeling test, rendering result test, interactive function evaluation, etc. The purpose of this article is to improve the content rationality of modern art design system and improve the application effect of 3D animation processing technology.

1.INTRODUCTION

Compared with the traditional two-dimensional animation processing technology, the three-dimensional animation processing technology is very weakly constrained by time and space in practical applications. Moreover, in different forms of expression, the image created by 3D animation technology is more vivid and more intuitive. By applying 3D animation processing technology to the art design system, it has a positive meaning to improve the rationality of system design content and enhance the value of technology application.

2.EXPRESSIVENESS OF 3D ANIMATION PROCESSING TECHNOLOGY

2.1.Lens Aspect

In the process of modern art design, the design content is closer to the movie scene, and the visual effect it brings is more shocking. In the application process of 3D animation processing technology, the content of the changes it brings is mainly reflected in the expansion of movie language. It can use the depth processing of space, the virtual nature of the camera lens, and the path system to realize the complete simulation of various types of techniques used in artistic design. This is conducive to allowing animation content to be processed using movie language, and enhances the lens sense of artistic design content. Moreover, in the processing of 3D animation, a virtual camera can be used to optimize some long shots, very close shots, and aerial shots. In this way, while ensuring that the content of the art design is not deformed, a more accurate sense of perspective can be used to complete the processing of different types and different angles of the lens. In this way, a great application breakthrough has been obtained in the expressiveness of the lens, thereby improving the expressiveness brought by the animation content.

2.2.Character Movement

In the traditional two-dimensional animation design process, the background and the characters used are drawn separately. This also needs to rely on the stacking order between layers to complete the interspersed processing of the perspective relationship. Under the background of traditional art design, the design is more difficult, and some uncertain problems are prone to appear. It can be seen that in the process of two-dimensional design, it is easy to ignore the role of the character mainly tends to move in the design process. For some more complex sports, it cannot be effectively described. When using three-dimensional animation processing technology to process it, we can use different methods and different angles to move in the virtual three-dimensional space. Moreover, in the process of use, a three-dimensional scanner and a motion capture instrument will be used in the processing process to comprehensively use the application structure, thereby providing the audience with a more vivid dynamic picture. This will also greatly improve the performance of the character's movement and meet the application requirements in different states.

2.3.Light and Shadow

When performing the art design system processing, some light and shadow processing will be used to set off the atmosphere. At the same time, different lights and shadows are also specific portrayals of the characters' inner activities. In previous art designs, hand-painted backgrounds, shading boards, and small props were often used to display light and shadow effects. The workload during the whole use process is relatively large, and there is a relatively large application difficulty in the scene interaction processing, and the expressive power may be in a state of insufficient. For such situations, when processing it with the help of 3D animation processing technology, virtual lights can be added to it for adjustment during the image processing process. This has also largely optimized the visual effects brought about. Moreover, in processing, light and shadow can also be used to highlight the key content of art design, helping people to more directly understand the main content of art design.

2.4.Detail Shaping

When performing art design activities, optimization of details is an important guarantee for rendering art design. The two-dimensional animated characters used in the traditional landscaping process do not have high requirements. However, there are many lines that need to be laid out in art design. If the relationship between the lines is not handled properly, it will directly interfere with the smoothness of the movement of the characters. Based on this, in the context of continuous optimization and development of 3D animation technology, the application advantages it brings are more prominent. For example, the simulation environment created by 3D animation technology can color different materials. And as mentioned above, 3D animation processing technology can use some virtual imaging information to create a suitable sense of situation. This also meets the basic requirements in the art design process and improves the level of shaping the target.

2.5.Visual Effects

Based on previous art design experience, it can be found that in the process of creating visual effects, freehand methods are used to display natural environment content in most cases. The freehand effect shown in this mode is relatively weak and cannot bring strong visual effects. For the currently evolving three-dimensional animation processing technology, in the specific use process, it uses a particle system to complete the natural environment processing. Moreover, in the process of use, it will use a unique application model to complete the structural modeling process. In the particle system, each particle has its own path, and the complexity is increasing. Relying on the art design system established by this model, it has more complex visual effects and a stronger sense of visual impact. This has positive significance for the intuitive embodiment of artistic design effects.

2.6.Traditional Elements

Except to the expressive content mentioned above, in the actual application process, 3D animation processing technology also has a strong use value in the application of traditional elements. For example, in some art designs, traditional Chinese elements such as ink painting, Chinese characters, and graphics are sometimes incorporated to add the artistry of the design content. For example, the Olympic monogram in the background uses the hieroglyph "person" with Chinese red, which is an intuitive embodiment of the application of traditional elements. The three-dimensional animation processing technology will also extract traditional elements during use, and then transform them to make it fit the current art design background. All of the application content will also be optimized in the scene design. Only in this way can the traditional elements be better rendered and highlight the application effects of traditional paintings.

3.SPECIFIC APPLICATION OF 3D ANIMATION PROCESSING TECHNOLOGY IN MODERN ART DESIGN SYSTEM

3.1.Logical Structure Establishment

Many disciplines such as art, computer science, and bionics are used in 3D animation. It is based on computer technology, through the full integration of art and computer graphics, to obtain three-dimensional animation pictures. It is precisely because the target object presented by 3D animation is based on computer technology, the content presented has the constraints of program setting and fixed viewing angle, and cannot adjust and interact with the animation content according to the actual needs and wishes of users. The immersion, interactivity and authenticity of virtual reality technology fully embodies the "people-oriented" and "intelligence" in the visual communication design system, which can specifically address the constraints of 3D animation. The logical structure of 3D animation optimization technology in the art design system can be divided into four main stages: pre-design, mid-term production, post-composition and interactive experience. The pre-design stage is the basis of 3D animation optimization, and the main processing content is script design, modeling design and scene synthesis. Mid-term production, post-composition and interactive experience are the keys to 3D animation optimization. The main processing content of the mid-term production stage is model construction, texture processing, rendering, etc. The post-synthesis stage is mainly for the processing of animation clips and sound synthesis, file generation and other content. The interactive experience stage mainly deals with the dynamic interaction between the user and the virtual three-dimensional animation scene [1].

3.2.3D Animation Modeling

The construction of multi-vision 3D animation model is based on the modeling and scene design in the previous design stage. It generates a depth judgment model in variational mode based on the image sequence at the key frame of the multi-vision animation, and obtains the original depth map of the animation by referring to the principle of discrete space sampling. It optimizes the depth model of the animation image through the initial duality principle, and solves the multi-vision 3D animation model based on this judgment. A (|waj|/αji,αT) and Qi are used to describe the camera pose judgment objective function and the initial map sampling area of the animated image obtained from the modeling and scene design in the early design stage. Among them, wji and αji respectively describe the unbiased estimation of the projection error and the matching standard deviation of the feature points in the i-th key frame of the animated image. Refer to the principle of the overall LM cluster correction to coordinate the completion of the initialization map. The formula is described as follows:{(τ1,τ2,⋯,τN){ y1,y2,⋯,yM}}= arg min∑A（|waj|/αji,αT ）. Among them: τi and yi respectively describe the camera pose six-tuple description vector of the i-th key frame of the animated image and generate 3D feature points of the scene. At this point, the system can assume that the multi-vision animation image has the light fixity and the smoothness of the depth map during use. At this time, the system can set the energy function model according to the existing data. The specific formula is as

follows: $W_d=\int_{\psi}$ （$W_{da}y_i+aW_{rc}$）d_a. Among them, Wda represents the data penalty item in the animation graph; Wrc represents the variational specification item in the animation graph; a represents the weight coefficient between Wda and Wrc. According to the formula to complete the data information processing, which establishes the preliminary application model of the art design system, in order to facilitate the smooth progress of the subsequent rendering processing work [2].

3.3.Animation Model Texture Rendering

After completing the above application processing, it enters the processing stage of animation model texture rendering. In the specific process, the used model coordinates and applied colors are important contents in the rendering process. In actual processing, texture mapping is often used to process the 3D animation model. The specific calculation formula is as follows:$r(x_n,y_n)=\phi$ （h（v,n））. Among them, r (xn, yn) represents the basic data of the mapping when the 3D animation is made, and ϕ (h(v, n)) represents the data package applied when making the 3D animation model [3]. The information that needs to be rendered is processed based on the content of the formula, and the matrix equation is also used in the texture processing. After the matrix model is applied, the pixel difference of adjacent positions can be solved sequentially. Meanwhile, the system can use the difference information to complete the model rendering process, which also effectively improves the model rendering process results. Moreover, this also brings good application effects to the optimization of model application content.

3.4.Dynamic Interactive Processing

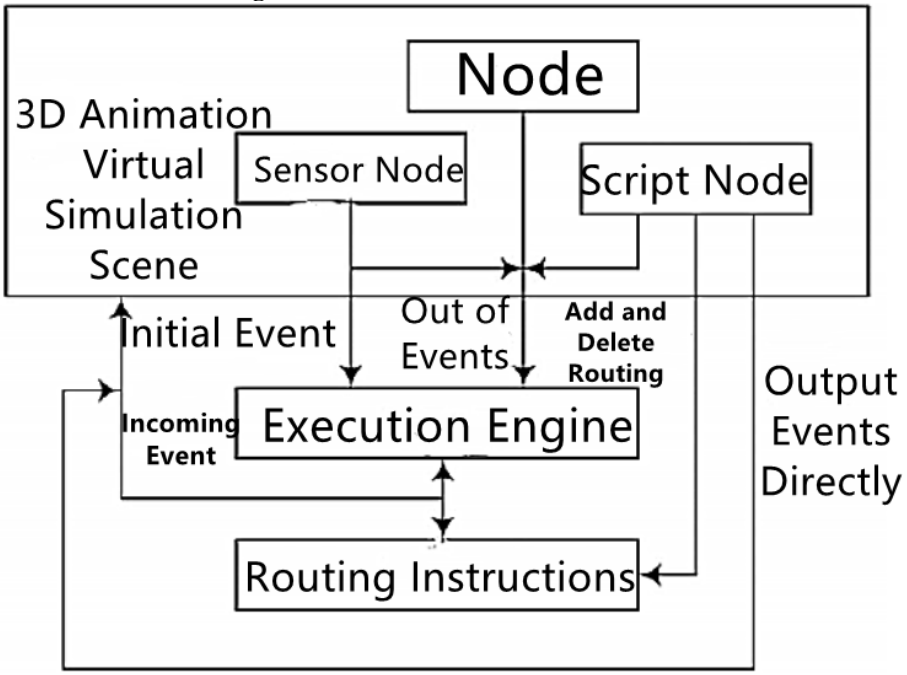

Figure 1. Schematic Diagram of Dynamic Interaction Processing Mechanism

As shown in Figure 1, when using 3D animation processing technology to optimize the content of the art design system, a corresponding interaction mechanism can be established to facilitate the smooth transmission of information. In order to facilitate the smooth communication between information, in practical applications, VRML language is often used for design. In this way, changes in the environment can also be used to optimize the specific application status and improve the stability of the system itself. In the process of processing the virtual scene of the 3D animation, we can use the entry and exit or entry management of the event itself to complete the information receiving or sending. At the same time, we can also use a certain node as the correlation point of the event, and then perform

correlation processing on other events. Moreover, in actual applications, dynamic interaction processing between information can be completed according to actual needs, and data information attributes and variables can be controlled, so as to ensure the smooth interaction and feedback of information between the system and the outside world. In addition, we can also adjust information according to user needs to improve the reliability of the system application process [4].

4.SIMULATION TEST ANALYSIS

4.1.Clear Test Environment

In order to ensure the feasibility and practicality of the art design system in specific applications, we will establish a corresponding test environment to deal with it. In the specific design process, we should pay attention to the following aspects. Firstly, we should make a good choice of testing system memory. Taking into account the high definition of the current image, the image has reached the 4K level. Regarding this, in memory selection, we should choose DDR 16GB or more memory, with Intel Core i5 tenth generation or above processors to meet the basic requirements for stable operation of the system. Secondly, in the choice of hard disk and display, we can set the hard disk to SATA 10 GB or more, and the display is no less than 800×600 pixels (32 or 64 bits) to meet the application requirements of the system. Thirdly, in the choice of operating system, Windows is the main choice. Currently, Windows 10 is the most commonly used, which can be used as the basic system environment required for this test.

4.2.Animation Modeling Test

In the process of technical processing, it is necessary to select 5-10 groups of test objects for processing, and at the same time rely on data information to complete the modeling process, and perform statistical analysis on the matching rate of each group of data. In this simulation experiment, the researchers selected six sets of data for overall planning and processing, and obtained the statistical results of data as shown in Figure 2 [5]. According to the data information displayed in the graph, it can be understood that in the process of 3D modeling, the average symbol point matching rate should exceed 91%. In the process of use, we will use the adjustment theory to optimize the technical parameters of the 3D animation. And in the process, we also need to process the average matching rate of technical feature points. After modeling, the average matching rate of all points is 93% and 93.65%. At the same time, the matching degree of the traditional technology used in the initial stage has been improved. It can be inferred that 3D animation processing technology can effectively improve the matching degree of data information in practical applications.

Group	Feature Points/Pair	Matched pairs/pairs	Match Rate%
Group1	429	402	93.71
Group2	367	341	92.92
Group3	512	477	93.16
Group4	483	458	94.82
Group5	504	483	95.83
Group6	399	365	91.48

Figure 2. Feature Point Matching Result Analysis

4.3.Rendering Result Test

In this experiment, the rendering result test is also needed, which is also an important guarantee to ensure the effectiveness of the art design system. In the actual application process, the system will apply the 3D animation model to each group of test experimental phenomena. The system also needs to perform virtual processing on the 3D environment after texture rendering to ensure the reliability of the processed results. Meanwhile, in the application processing, the system will also perform statistics on

the texture rendering and view the rendering effect. During the rendering process, the size and content will also be adjusted, and the rendering speed will be set to a fixed value, so as to facilitate the concentrated discussion of subsequent application data [6]. As shown in Figure 3, under the condition that the rendering speed is consistent, the pixel values after rendering maintain high consistency under different scale backgrounds. Moreover, the effect has not changed significantly, and it has good use value.

Number	Scale	Pixel/dpi after rendering
1	200×180	77.7
2	400×360	77.7
3	800×720	77.7
4	1200×1080	77.7
5	1400×1260	77.7

Figure 3. Rendering Effect Comparison Chart

4.4.Interactive Function Evaluation

After completing the above processing work, it enters the evaluation processing stage of the interactive function. During this test, we can select several groups of professionals to experiment with interactive functions. The evaluation process uses a hundred-point system to obtain more intuitive evaluation results. Otherwise, in order to improve the generality of the evaluation results, the system will remove the highest score and the lowest score in the score, calculate the average value of each set of data, and then draw it into a table for analysis. According to the feedback data obtained, we can understand that after the 3D animation processing technology is applied to the art design system, the average evaluation results of its interactive functions are all above 90 points. Compared with the traditional art design mode, its interactive function is more stable, which is also conducive to timely changes in the art design process. Furthermore, this can also satisfy people's handling of related information and improve the reliability of the design results [7].

5.CONCLUSION

To sum up, in the modern art design system, people have more requirements for the aesthetics and appeal of the content of the art design, and it is difficult to meet the requirements relying on the traditional design mode. Three-dimensional animation processing technology has many advantages in application. The application of three-dimensional animation processing technology to the art design system can not only increase the richness of the design system content, but also has a positive meaning for improving the aesthetics of the design content.

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