

Research on the Innovative Design of 3D Modeling Technology in the "Meta-universe" Virtual Idol

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Abstract

"meta-universe" virtual idol refers to the virtual image made by people on the computer, can also refer to the virtual anchor or virtual video master, through the virtual avatar deduction or creation of the video author. This paper combined with the new digital technology, explore the use of 3D modeling technology to create virtual idol corresponding ideas and scheme design.

Keywords

Metaverse; Virtual Reality Technology; Three-Dimensional Modeling; A Virtual Idol; PBR Technology.

1. Introduction

With the development of science and technology, the term "metaverse" has been mentioned in many different fields. The following virtual idols have also become a hot topic. As early as 2008, Hatsune Miku became famous in Japan as the first virtual idol to hold a concert using holographic projection technology. Countless young people were attracted by their cute physical condition and crisp electronic voice. After several generations of virtual idol development, the current virtual idol has been evolving into various forms, the interaction is more and more strong. Recently, more and more virtual idols have appeared in the game live broadcasting industry and short video community platform. They have received good market feedback in the aspects of enterprise publicity, product endorsement, IP building, digital employees, etc., and have been unanimously praised by the audience. According to the data of Qianzhan Industry Research Institute, the revenue of China's live video broadcasting industry reached 108.2 billion yuan in 2019. There are 390 million people following virtual idols across the country. Among them, the monthly active users of B site, the largest 2-yuan activity community, reached 11.4 million, and virtual anchors accounted for 40% of the revenue of live streaming. During the same period, large-scale live streaming platforms such as Station B and Huya also launched online and offline virtual anchors. As one of the supporting technologies of virtual idol, 3D modeling technology has once again become a popular learning subject. This paper focuses on the application of new modeling technology in creating virtual idol by focusing on the latest 3D modeling technology.

2. High-precision Model Technology of the Next Era

2.1. Low-mode Wiring

Low mode is the starting stage of creating a model, but it is also the final model displayed in the engine, its importance is self-evident, not only determines the start of the project, but also related to the project display. 3DS Max, MAYA, Blender, etc., are some of the most commonly used software for low mold production. It can be seen from the literal understanding that low modulus means the model with low number of faces in polygon modeling. Because of this feature, low modulus is used as the final model of the engine to save resources and improve the smooth operation of the project.

A 3D model that is convenient for post-production animation should be based on quadrilateral wiring. Triangles should be used as little as possible in major structural corners and five-sided points should be avoided. The wiring should ensure that no polygons above quadrilateral can appear.

All parts of the model should be kept as even as possible to make the transition in the animation deformation process natural and smooth.

The model should be a complete closed structure, with the normal line of the model facing outwards, so as to avoid model opening and plane breaking during the modeling process. If the model opening or normal orientation is wrong, the model will be imported into the engine and the model will appear to be incorrectly transparent.

Do not have any points, lines or surfaces inside the model, otherwise it will cause a large amount of resource waste.

The soft and hard edges of the model should be set correctly in the low mode state. In the virtual role, generally speaking, the turning Angle between the face and the face is less than 90 degrees, and the common edge of the two faces is set as the hard edge, and the other side is set as the soft edge. In most cases, living things, natural objects are almost all soft edges; There are more hard edges in artificial objects, such as tables, chairs, guns and ammunition.

2.2. Medium Die Card Cable

Through many experiments, it is found that before entering the high mold engraving, making a middle mold first will play a very obvious helping effect on the high mold engraving later. In addition to the production rules of the middle mold on the basis of the low mold, it is also necessary to make an overall arrangement of the details of the overall model distribution. In order to facilitate the high mold engraving details, in advance in the middle of the distribution of dense wiring, dense details of the area and turning sharp hard edge can be appropriate to increase a few circles of line segments. The purpose of the whole middle mold card line is to maintain the profile of the high mold Divide consistent with the low mold after the upgrade, and the distribution of the wiring density is to provide sufficient surface support for the high mold carving details.

2.3. High Mold Carving

The number of high-profile faces is between 4 million and 40 million. A full CG character has more than 100 million faces. In the case that low mold is not enough to express the amount of detail of the original painting, the process of making high mold will be used. Nowadays, almost most games, including mobile terminal, PC terminal and console terminal, adopt the method of high and low mold baking to get Normal map to solve the problem that low mold cannot express enough details. This process is also known as the next generation model making process, its advantages are: the use of high modulus can effectively reduce the machine running load, improve the software running speed; The application of high mode can improve the speed and quality of mapping, thus improving the overall model of the art effect. However, the disadvantages of the model making process in the next era are also obvious: the process of high model making is extremely complicated, involving more software and technology, and the learning cost is greatly increased; In addition to improving the quality of the model, the production time of the project is greatly extended.

There is no need to do surface smoothing when making high die. Because the smooth edge of the model depends on the low mold, the smooth production of the high mold will lead to the high mold edge cannot perfectly match, baking does not have any meaning.

High die in the production process does not need to maintain low die wiring and UV. High mode only needs to be determined to have details, wiring in the case of not affecting the surface of the model can be played at will. In most cases, the high die does not need UV, as long as the low die

has the right UV. Because the baking information is passed from the high model to the low model, the low model will eventually use the baked texture.

Chamfer process is performed at a hard-edge bend. A three-sided Chamfer can be used, and the number of sections can be appropriately increased for a large corner. Black edges and other problems will not occur in high mode when the soft edges are all set, as shown in Figure 1.

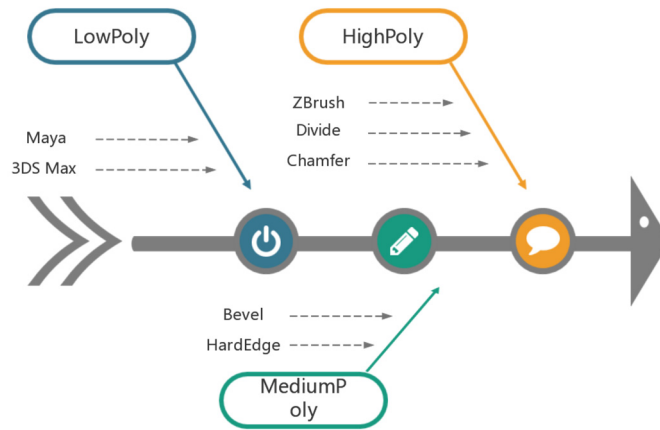


Fig 1. 3D Modeling technology

3. UV Technology

3.1. Spread UV

UV is the state presented by the expansion of the three-dimensional model in a plane. UV is flat, U and V represent the two directional axes of the two-dimensional plane. UV is used to carry various maps, and its size determines the size of the pixel of the map. The following points need to be noted in the virtual idol UV expansion:

The UV should be disconnected as far as possible in places that are not easily observed. Map seams will inevitably appear at the UV break. The baked Normal seams can be corrected with manual PhotoShop. In addition, high resolution mapping can greatly reduce the seam effect.

The UV of the model is kept at uniform accuracy. After the experiment, it is known that if the size of the UV is not uniform, it will cause the model part of the map area is delicate and the other part is quite fuzzy, resulting in visual discomfort and disharmony.

UV accuracy of individual accessories can be appropriate to float up and down. If completely unified precision will lead to some virtual idol accessories map details are seriously insufficient, such as some metal rivets, screws, eyeballs, watches and other details are very rich but their own volume and small objects can adjust their UV size according to the amount of detail. In order to maximize UV utilization and map distribution, it is common to shrink invisible inner UV or very simple material parts many times.

The UV at the hard edge of the low die must be disconnected. Because the baking will recognize the soft and hard edges of the model, the soft edges of the baked Normal will have a gradient effect, whereas the hard edges of the baked Normal will not. Therefore, this step is to ensure that the baking Normal display is correct, if the hard edge and constantly open UV, there will be a Normal display error at the hard edge, as a thin black edge. Other places to disconnect the UV can be set at any soft edge. That is to say, the place where the UV is disconnected is not necessarily a hard edge, but the hard edge must be UV disconnected.

There are twice as many pixels between UV and UV as there are between UV and the boundary. In a 2048*2048 UV map, the ideal space is 32 pixels between UV and UV, and 16 pixels between UV and the border. UV map 1024*1024, with 16 pixels between UV and UV and 8 pixels between

UV and border. Tiles will inevitably be compressed and optimized after entering the engine, and keeping a certain spacing ensures that tiles will not be interwoven during compression, which will lead to a decrease in picture quality.

3.2. UDIM Multi-quadrant UV Technology

UDIM, full name U-Dimension, is a set of multi-quadrant mapping technology. UDIM allows a complete model UV to be divided into independent parts of UV, and presents the overall UV in a tiled manner. For example, a complete virtual idol can split its UV into head, hands, body, clothes, equipment and other parts of UV, which are distributed in different UV quadrants, but can also be packaged into the overall UV of a virtual idol role of UDIM. This technology has obvious advantages in the splitting of UV models: for example, in the application of film and television models, due to the limitations of software and hardware, it is impossible to directly produce maps with large resolution, so this technology can be used to divide the whole UV into four sub-UV, which are distributed in different quadrants. The 16K map can be divided into four 8K maps for drawing. The original limit is broken and the quality of the map is guaranteed.

4. PBR Technology

Physically Based Rendering (PBR) is a technology that deduces or simplifies or simulates a series of rendering equations by using the principles and theories of the real world and relies on computer hardware and graphics API to render the exact picture. PBR is the most popular modeling technology process in the field of 3D modeling at present. Its main characteristics are 1) conservation of energy, reflected light is not brighter than when it first hit the surface of the medium. 2) The high light reflection is controlled by the BRDF bidirectional reflection distribution function. In the aspect of high light reflection provides a better solution. 3) Finier effect. For non-metallic materials, the reflection of the surface at an Angle perpendicular to the camera is between 2% and 5%, while for metallic media this parameter is much greater, showing between 70% and 100%. 4) Linear space rendering. The PBR process is divided into three maps, each of which serves to define the properties of a material surface.

The first tile -- BaseColor. RGB map refers to the surface color of an object that does not contain any light and shadow information. Can be understood as the object's natural color, rather than diffuse color.

The second post - Metalness. Grayscale map, used to distinguish metal from non-metal objects. This map is black for non-metal and white for metal.

Step 3: Roughness. Grayscale map, used to describe the roughness of the object's micro-surface. Black for smooth and white for rough. Roughness map (ROUGHNESS map) is a very important map in PBR process. Its quality greatly affects the final material effect of model.

Through the combination of the above three postings, high-quality and diverse material effects can be rendered under the PBR environment. Compared with the traditional process, the advantage of PBR technology is that because PBR has its exact formula to calculate the surface characteristics of objects, the objects created are more realistic and can reflect the surrounding environment correctly under various light sources, which is very realistic. It makes the focus of mapping work shift back to artistic creation.

5. Baking Techniques

Baking is the process of converting the three-dimensional information of the high mode into a two-dimensional map and pasting it back to the low mode, so that the low mode has the surface information of the model visually equivalent to the high mode. There are a lot of baking software, such as 3DS Max, Maya, ZBrush, etc., which can be used for high and low mode baking. However, the baking conditions are relatively strict, the baking parameters are too high, and

the learning cost is large. Xnormal software, which has the largest number of users earlier, is relatively simple, with small volume, simple interface and single function. In addition, the MarmosetToolbag is extremely powerful for baking and is loved by high-end modelers. SubstancePainter software for beginners friendly, with baking speed, fewer parameters, easy to master the characteristics.

Two things need to be done before the formal baking: First, the low mold overlaps the high mold perfectly. Second, the low die has a reasonable UV, and must be in the first quadrant, the overlapping UV needs to be shifted by one quadrant.

The common types of baking maps are:

Normal, the most critical figure, carries the surface bump information of high mode. This map is slow to bake.

Ambient Occlusion, short for AO map, is an occlusion model, SP is an occlusion effect. Some high quality project models need to export this map to enrich the model rendering quality. This texture will bake very slowly.

World space normal, a map representing the spatial location of the model's world.

Curvature, performance model grooves and corners, is the most powerful performance shabby texture map.

Position, where is the top of the reaction model, where is it low, where is it left, where is it right. Thickness map reflects the thickness of the model. It's not usually used, but it's a crucial one for character skin 3S textures.

In this section, the above modeling ideas can now be summarized as: low mode -- medium mode -- high mode -- displaying UV -- baking -- material mapping, as shown in Figure 2.

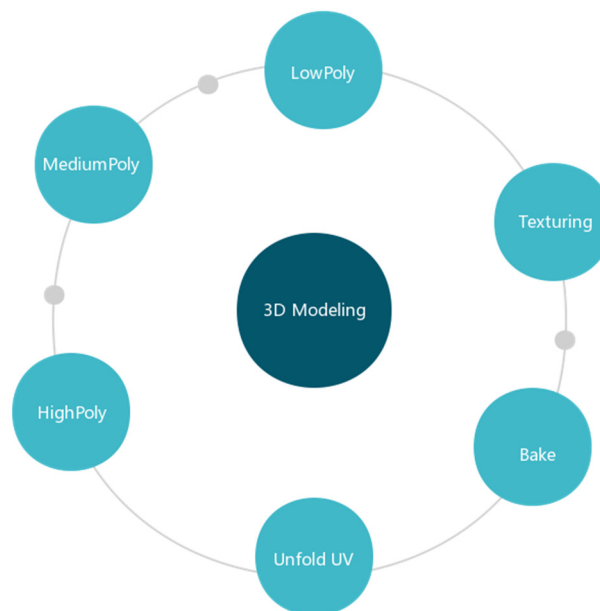


Fig 2. Technological process

6. Hair Technology

There are three main ways to express hair:

First, the model entity hair, the performance of stylized models, game animation industry is widely used. The advantages are simple and quick, the disadvantages are weak layering, poor hair texture, complex hairstyle is difficult to achieve, not suitable for realistic roles. You can use Maya, ZBrush software to make it.

Second, 3D software hair add-ons, such as Xgen. It is widely used in the realistic character static frame works and animation film and television industry, and is also a commonly used hair production method for digital people and virtual idols. The advantage is that the effect is lifelike and the software is powerful, which can realize the modeling of complex hair. The disadvantage is that the rendering time is long and the learning cost is large.

Third, insert piece hair, is the most mainstream method in the game industry. The advantage is relatively save computer resources, the disadvantage is the chip process is longer, the time consumption is large. Often 3DS Max or Maya software is used to make insert hair. With the rapid development of game engines and the constant change of new technologies, chip hair has gradually become a key technology in the mainstream hair production process.

7. Conclusion

Compared with 3D scanning technology, the application of 3D modeling technology can greatly improve the freedom of virtual idol creation. Compared with holographic imaging technology, the application of 3D modeling technology can improve the verisimilitude of virtual idols in all aspects. Even so, 3D modeling technology still has great application space and development potential in the stage of virtual idol. Highly customized virtual idol is the development trend of "meta-universe", which also puts forward more efficient process innovation demands and higher quality model requirements for 3D modeling technology.

Acknowledgments

Fund Project: Wenzhou Vocational and Technical College 2022 Research Project (WZY2022 050).

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