Research on the Technical Exploration of 3D Graphics Engine Animation

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Abstract: Virtual reality is a high-tech frontier technology that has emerged in recent years. The three-dimensional graphics engine is the software foundation for realizing virtual reality. With its own advantages, the 3D graphics engine is involved in the animation production process, which not only can double the production efficiency, but also consumes a lot of time waiting for the traditional animation software to render. It can also be modified in real time during production, and its editability is very high. This paper compares the current mainstream 3D graphics engine classification, introduces the basic architecture and production principles of the engine. The popular Unreal Engine, Unreal Engine4, was selected to describe the process of making 3D animations, analyze the differences between them and 3D traditional animation methods, and the commercial development needs of animations produced by Unreal Engine in the future. The development of 3D animation has been greatly advanced through the involvement of the 3D graphics engine.

1. What Is A 3D Graphics Engine?

The 3D graphics engine has been in development for more than 20 years and has become the most widely used commercial engine in the world. Whether it is in PC games, console games, mobile platform games, VR games or even real estate design, industrial simulation, military and other fields, there are a large number of works using 3D graphics engine. There are also more and more developers turning into the development team of 3D graphics engines [1].

2. Mainstream 3D Graphics Engine

At present, a large number of game special effects and film special effects companies began to focus on the research of three-dimensional graphics engine, and independently developed a batch of application software. The five mainstream virtual engines are the ORGE engine, the Unreal Engine4, the Unity engine, the Gamebryo engine, and the Bigworld engine. The ORGE engine is a free open source engine, and the remaining four engines are paid commercial engines.

Contrast from basic functions: OGRE engine is fixed rendering channel, rendering texture, font, graphical user interface; light source system belongs to vertex, pixel, light mapping; scene management is common mode, BSP, occlusion culling, LOD, Octtree; texture The system belongs to basic texture, multi-texture, bump texture, projection texture, body texture; physical system is collision detection and cylinder; Unreal Engine4 is fixed rendering channel, rendering texture, font, graphical user interface; the light source system belongs to the apex, Pixel and illumination mapping; scene management is common mode, BSP, entrance-based visibility discrimination, occlusion culling, PVS, LOD; texture system is basic texture, multiple texture, projection texture; physical system is collision detection, rigid body and vehicle physics The Unity engine is a fixed rendering channel, rendering texture, font, graphical user interface; the light source system is a highly sophisticated light and shadow rendering system; scene management is normal mode, BSP, occlusion culling, LOD, PVS; texture system is basic texture, multiple Texture; physical system is built-in PhysX physical reference The Gamebryo engine is a fixed rendering channel, rendering texture, font, graphical user interface; the light source system is a vertex, a pixel; the scene management is a multi-thread management system, PVS; the texture system is a basic texture, dynamic texture; the physical system is integrated PhysX system to Gamebryo; Bigworld engine is fixed rendering channel, rendering texture, font, graphical user interface; light source system is

vertices, pixels; scene management is quadtree, supporting seamless connection between indoor and outdoor environment; texture system belongs to Basic texture, multiple textures; physical systems are simple physical systems [2];

Animation interactive function comparison: OGRE engine animation system inverse kinematics, skeletal animation, Skeletal-Ani, motion blending, Blending; artificial intelligence system does not support; Unreal Engine 4 Unreal Engine4 animation system supports key frame animation, skeletal animation, animation mixing; artificial intelligence The system supports path finding, decision making, finite state machine, script; Unity animation system supports DCC and other tools to export generated animations, scripts to control animation playback; artificial intelligence system does not support, need to write script AI; Gamebryo engine supports skeletal animation, facial animation, Hierarchical animation, animation sequences, mixing of animation and physics simulation results, mixing between animation sequences; support for artificial intelligence systems, providing artificial intelligence with XaitmentAI middleware; Bigworld engine supporting complex skeletal animation above four bones; supporting artificial intelligence;

Each 3D graphics engine has its own advantages and disadvantages. It is difficult to standardize the performance to measure performance. After years of development, many successful cases have been produced using 3D engine technology [3].

3. Traditional 3D Animation Production Method

The traditional 3D animation production process is based on Maya's production platform with other DCC and renderer-assisted processes, which is used by most animation companies. This process is briefly a model, binding, animation, material, lighting, rendering a series of sequential processes, mainly based on Maya, other DCC assist, is a linear non-destructive process. The benefits of this process are mature technology, high controllability, rich talent pool, good operation under the existing talent structure, and strong team strength. The disadvantage is that the technology determines the number of team links, the scale is large, the modification after rendering needs to be repeated once before the process, the modification cost is large, and the team's grinding is high. Nowadays, the 3D graphics engine makes animations to judge the modified model lights more quickly. The 3D graphics engine has instant rendering technology, which is convenient for real-time modification of light and shadow effects, material texture and special effects, saving a lot of rendering time cost. Therefore, it is easy to obtain excellent works by improving the time for judging the modification of the light and shadow material.

4. Animation based on Unreal Engine 4

Unreal Engine Unreal Engine4 is the latest version of the world's top game EPIC Unreal Engine. It is a game development platform that provides a large number of core technologies, data generation tools and basic support for game developers. As we all know, Unreal Engine 4 is often used to make games. Due to its excellent picture performance, it has gradually begun to be applied to many fields such as film and television, advertising and so on. Using the game engine to make animations is called engine animation. Combining the real-time rendering and modification capabilities of the game engine to create animation is one of the effective ways to solve the production efficiency of 3D animation. As we all know, Unreal Engine 4 is often used to make games. Due to its excellent picture performance, it has gradually begun to be applied to many fields such as film and television, advertising and so on [4].

As a new production animation platform, Unreal 4 is not perfect enough for the corresponding process and talent pool. Unreal 4 is still very different from the Maya process throughout the process. First, create assets (models, textures, bindings, animations, simulations, etc.) in DCC. You can also get the corresponding character model by using digital engraving technology (Zbrush), assign materials and textures to characters, and bind certain bones to character models. Or use the motion capture system to create the corresponding skeletal animation, then import it into Unreal 4, build the scene in Unreal 4, write the material, light, create a sequence, edit the material and then

output such a process. Compared to Maya's linear process, the Unreal process is a non-linear process. In the process of Unreal 4, each node can be modified during production. The editability is very high, and the impact on other links is small. The most obvious is that the lights can be modified at any time. , ready to output. Such a link can be said to release huge potential for the creators. In the traditional process, the creative team can see the finished product almost at a later stage, and the process of Unreal 4 has no such restrictions at all. The official definition is based on The director can look at the whole picture.

The world's first cartoon "Zafari" made with Unreal 4. Zafari is an animated film directed by David Dozoretz, and the production company is Digital Dimension. The Zafari project is the first animation to be completely presented in the virtual game engine. The director has a lot of doubts at the beginning. It needs to meet certain production quality, and needs to render subsurface scattering, ambient light shading (AO), vector based. The dynamic blur, but also to make the appearance of real water, and the production team using UE4 has accelerated all these problems. Large projects like "Zafari" have 10,000 shots. The number of shots in animation is particularly large. It needs to reach the release rate and minimum error of one episode a week. Rendering is always the biggest pressure. Traditional processes can be tested and rendered in one day, using UE4 to complete 20 times in a few hours. Each set requires about 20 nodes, and the traditional process may reach more than 120. This is like just completing the action, and after 10 minutes, you will see the rendered shot. Do all the work in Unreal 4, the effects are almost real-time, lighting, special effects and even rendering and synthesis are done in the engine, you can see the final effect in real time, basically for the studio to promote many advantages. To complete such a project on a traditional workflow, there are usually three to eight people in a lighting department. Now, in terms of the size of the lighting and rendering teams, it has been reduced by about 75% from the traditional process, and hundreds of times more efficient in given artist efficiency and productivity. This can really motivate the designer to work in real time. On the other hand, costs are falling and quality is improving.

These advantages make the Unreal Engine 4 ideal for making a series of cartoons. The domestic animation - "Ge Ling Qu", developed by Shenzhen Zhuohua Entertainment, using Unreal Engine 4, adopts the form of drama and play, which is comparable to the quality of cinema movies, which has attracted more and more attention to this animation. It is worth mentioning that the "Spiritual Songs" that incorporates the Chinese culture are very beautiful, and they are excellent in terms of background, light and shadow, characters, colors, lines, etc., thanks in large part to the spirit. The song uses a different way of making. The domestic animation that uses UE4 rendering - "Soul of the Earth" is very distinctive in the use of the lens. The producer is very bold in the use of the lens, and the push and pull shakes are all available, and the viewers are very enjoyable. Each shot of traditional animation is designed in the split stage, and there is no way to modify it repeatedly if the effect is not good. However, the "Essence of the Earth" has UE4 participation, which makes the production efficiency improved, the modifiability is high, and there are more tricks to play. More trials and adjustments can be made in UE4, giving the creator more room to express and bring a richer experience to the audience [5].

The use of UE4 in the mutual entertainment of the fire is an attempt to improve the efficiency of animation production. The domestic animation production company's technological innovation and progress are at the forefront of technology. I believe that with the optimization and improvement of UE4, more and more beautiful "engine animation" mode animations will appear in the market in the future.

5. Conclusion

Based on the application of 3D engines at home and abroad in the field of 3D animation, engine technology is used to optimize the animation production process. The advantages are reflected in all aspects of each process. In the early stage, the story, structure, style, character scene setting, background music and other aspects of the script need to be changed many times to better subdivide each sub-lens. For the previous revisions, a lot of preparation work and manpower consumption are required in traditional animation production. But for the intervention of engine animation,

"real-time modification" and "real-time rendering" are realized in the production, and the advantage of WYSIWYG is used to present the combination of animation segment and lens. Into the mid-stage of animation, the action of the character, the expression and the mouth shape, the rendering of the atmosphere, the conversion of the scene, etc., the amount of work content is large, and efficient production efficiency is required. In terms of special lens adjustments and modifications, engine technology can better control the content of the screen by executing code. Such as the cluster animation in the lens - the war scenes of thousands of horses, each character can not simply paste and copy, the action of the battle can not be the same. Individual adjustments are required for each character in traditional animation. If there are 500 characters, each role is adjusted for 10 minutes, then it takes nearly 4 days. However, in the engine, you can control the cluster animation through scripts, such as walking, running, attacking, avoiding, etc. through the script control to adjust. It can be done in a few hours. More editing and special effects techniques are needed in post production. In traditional animation production, special effects require professional personnel to carry out repeated modification and running-in to achieve. It consumes more manpower and material resources, time and creative costs. Using engine technology, special effects can be modified and rendered in real time through parameter adjustment of the particle system to achieve visual display of different effects. A variety of special effects plug-ins can also be used to achieve dynamic atmosphere and achieve diverse control.

At present, the 3D engine is completely feasible and the advantages are obvious, but it has not yet reached the point of technically completely rolling off the offline rendering. This also has a development period of several years or ten years, giving technology. The time of development and the time of talent growth, real-time rendering animation will become the mainstream in the industry.

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