Narrative Experience of Animation Based on Virtual Reality Technology: Take the *League of Legends: Arcane* as an Example

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Abstract. This paper first analyzes how *League of Legends: Arcane* uses the virtual camera mappingtechnology to achieve the audience's personal narrative experience; Then it analyzes that the on-site immersion of virtual images realizes the audience's aesthetic transcendence from visual wonders to emotional experience, and obtains a more real, rich and free viewing experience. On this basis, it summarizes that the effective intervention of virtual reality technology has developed human sensory functions, improved the all-round emotional experience, and the audience's vision has followed the development of technology into the combination effect of virtual images to experience narrative wonders. Virtual reality technology gives us the possibility to talk about the relationship between people and images beyond the dualistic opposition mode. With the revolutionary development of animation technology, narrative experience will become the core of animation creation.

Keywords: Virtual reality technology · Narrative experience · Animation · *League of Legends: Arcane*

1 Introduction

In 1999, American scholar B Joseph Pine and James H Gilmore put forward the concept of "experience economy" [1]. It is believed that with the advent of the era of experience economy, technological creation has become an important guide for consumers to participate in a beautiful consumption experience, and the "experience" integrating material enjoyment and spiritual enjoyment creates economic effects. In the era of experience economy, the film viewing experience based on virtual reality technology is a typical embodiment of the experience economy in the field of film cultural consumption. In the virtual image context, the viewing experience full of physical perception is interwoven with the subjective imagination of the viewer.In the animation production process, the application of virtual reality technology can make the screen more natural and rich, make the audience feel more vivid, and improve the viewing experience. It is an indispensable core technology in the animation production process. At the same time, the emergence

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of virtual reality technology has led to the continuous integration of human living environment and technological environment, and the development of technology is centered on the expansion of the perceptual content of the body. Don Yide proposed a model of embodied relationship of "body technology world". The particularity of this embodied relationship lies in the fact that media technology reconfigures the temporal and spatial elements of perception and experience [2].

The animated work League of Legends: Arcane, adapted from the online game League of Legends, has caused great repercussions around the world, The reason for the success of animation is not only due to the high production level of animation studio, Fortiche, but also due to the deep participation of the production company Riot Games in the production of this animation. League of Legends: Arcane took nearly six years to complete the production. The work uses the world's top "Non-Photorealistic Rendering" technology. With more than 7000 shots and tens of thousands of hand-painted original paintings, it delicately depicts different scenes, micro-expressions, inner emotions and other details of characters [3]. The traditional 2D hand-painted background + 3D character modeling + Non-Photorealistic Rendering's Arcane may bring us some new animation design ideas. Based on the above theories, this study will focus on the following issues: How does virtual reality technology enhance the narrative experience of viewers? How can the embodied practice based on virtual reality technology achieve sensory experience interoperability?

2 Space Immersion of Spectacle

Virtual reality images cater to the audience's needs for viewing and immersing themselves in the narrative space created by the images. The animation Arcane has a large number of digital hand-painted landscapes, but it restores the original artistic style of the screen in the space constructed by three-dimensional technology. This perfect connection between three-dimensional and two-dimensional is thanks to virtual camera mapping technology.Virtual mapping technology projects two-dimensional images onto three-dimensional geometry through projection, transforming digital images into scenes with three-dimensional attributes, and completing the synthesis of camera lens images in three-dimensional space. Because its imaging medium is mainly a three-dimensional geometric model, the projection area of the camera is limited by the range of viewing angles. It is necessary to project three-dimensional geometry while maintaining a uniform viewing angle between the camera and projector. The focus of this technology is to obtain spatial and media related data from the lens image, and accurately synthesize the two-dimensional image into it.

First of all, the premise of realizing the camera mapping technology is the unity of the main camera angle. The realization of projection is composed of camera, 2d image and imaging media. According to the projection mathematical representation (Fig. 1), the equation of camera perspective projection can be obtained from the projection imaging principle: $x = f\frac{X}{Z}$ $y = f\frac{Y}{Z}$, To ensure that the coordinates of the two cameras remain in the same main shooting direction, assuming that the coordinates of the camera and projector are the same, under the known coordinates of a point p (x, y) of the 2d image and a point p (X, Y) of the imaging geometry, the correct multiple relationship between

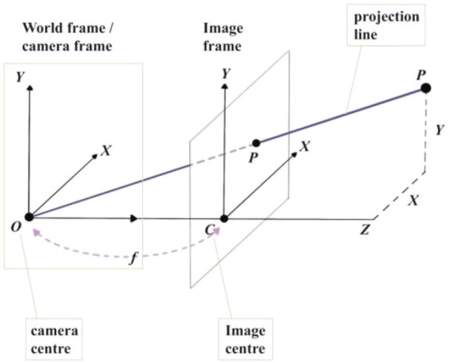

Fig. 1. Math representation of projection

the imaging focal length f and the main shooting axis Z in the same main shooting direction can be calculated according to the perspective projection equation (Fig. 2).

Second, due to the fixed imaging angle of view, the change of the spatial perspective relationship of the lens image is limited. It is necessary to confirm the correct position relationship between the camera's main shooting axis and the imaging geometry to ensure that the image projection content does not have the error of the imaging position. Therefore, assuming that the spatial coordinates of the camera and the focal length f of the 2d image are known, the point p (x, y, f) on any point image can be selected, and then the multiple relationship between f and Z obtained above can be used to obtain the value of the main camera axis Z, and then the coordinates (X, Y) of the corresponding point p (Scene Point) of the imaging geometry from the p point (Image Point) projected by the 2d image can be obtained according to the projection equation.

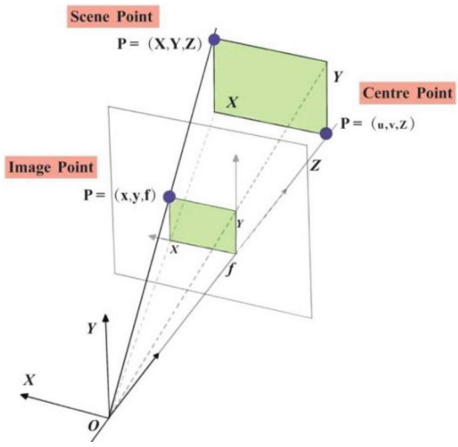

Fig. 2. Projection Diagram

Third, because the projection object is a three-dimensional geometry, the display space in the lens image is limited by the main camera angle. During the camera movement, the perspective relationship of the image will change, and the places that are not projected will have a phenomenon similar to image stretching. Therefore, it is required to obtain the camera movement data and the acceptable movement range in the camera mapping direction. Through data comparison, Determine whether the lens image needs to be mapped by multiple cameras. Based on the multiple relationship between the focal length f and the imaging axis length Z known above, assuming that the corner coordinates of the projection picture have been determined to be (X, Y, Z), the axis coordinates of the projection picture (u, v, Z) can be obtained. According to the projection imaging equation, the camera coordinates (a, b, c) can be randomly selected and substituted. If the two groups of focal length f obtained are different, or the multiple relationship between the obtained focal length f and the axis length Z is incorrect, The selected camera coordinates exceed the acceptable range of movement in the mapping direction, and multiple cameras are required to project onto the imaging medium.

3 Spatiotemporal Immersion in Perceptual Motion

In Merleau Ponty's "body-subject theory", experience depends on perception, and perception cannot be separated from human's "body-subject" role [4]. The audience's perception of image symbols is realized based on the biological conditions of the "body". The formation of a sense of viewing experience is not only rooted in the body, but also formed through the interaction between the body and image space. Animation is a timeless art that takes frames as the smallest unit of time. The diachronic relationship between frames is the key to animation's expressiveness. It involves both frame modeling and frame dwell. Animation artist Norman Mclaren believes that "animation is not the art of painting that can move, but the art of painting that can move. What happens between frames is more important than what exists on each frame" [5]. The temporal connotation is of great importance to animation media. The connection between frames is more important than the content of frames.

The production team of Arcane uses hand-painted frame-by-frame special effects to achieve a balance between realistic and cartoon styles. Using the temporal connotation of frames, they integrate special effects into three-dimensional character movements, creating different narrative experiences in the form of multidimensional effects. The fighting scenes in the film use frame by frame special effects and the coordination of characters to enhance the dynamic expression of the screen. Starting from the dimension of the frame, the three-dimensional character dynamically improves the frame's image shape. For example, the female leader's head is compressed, and the attacker's abnormal body deformation occurs. These changes are accurate to the time point of the action's force, and non physical visual processing is performed on the character's posture. This effect is presented based on the application of three-dimensional deformation technology, mainly including: free form deformation technology Skeleton Subspace Deformation.

skeleton driven deformation is the process of adding bones to a 3D model and binding the bones to vertices on the 3D model, also known as "skinning technology". This technology defines the skin motion of a model as a bone function. When a bone changes,

each skin vertex will be affected by different associated units and generate motion, known as skeleton subspace deformation (SSD) [6]. The expression is: $u_i^1 = \sum_{g=1}^{s} w_{ig} t_g u_i$ Among u_i^1, u_i refer to the spatial position of the ith vertex in the model before and after deformation, g represents the weight of the ith vertex control corresponding to the gth control joint on the skeleton, S represents the number of control joints on the skeleton, t_g represents the local transformation acting on the control joint. They can be controlled by the user's own input of numerical values, or input through action capture and other methods. w_{ig} is weight addition values, indicating the degree of influence of the skeleton on the vertex. By changing the weight distribution of vertices using this technique, the model can produce a smooth and organic deformation effect during skeleton editing. It should be noted that in terms of deformation details, it is necessary to determine the weight value of each bone for each mesh vertex in its influence area.

4 Perception of Emotional Immersion in Time and Space

Body not only changes technology, but also reshapes individual emotions and bodies. Don Yide calls it "technical body" [7]. Arcane integrates the hand-painted style into the three-dimensional space and achieves the harmony between the characters and the environment, which benefits from the coordinated application of Non-Photorealistic Rendering and camera mapping. Non-Photorealistic Rendering takes stylized shading, edge tracing, editable highlights and shadows as its core functions [8]. In 3D animation, it mostly uses cartoon shading for shading and rendering, but using cartoon shading cannot solve the problem of material stylized rendering in the film. Because the cartoon material is still generated based on the computer's light calculation, the rendering effect cannot restore the two-dimensional hand-painted texture, so the producer uses the combination of camera mapping and cartoon material to solve the problem of character shading.

Most of the scenes in Arcane are presented in digital landscapes, and the lighting sensation of the screen is drawn by imitating natural light and shadow. Therefore, the texture and lighting of animated characters should also exhibit the characteristics of light and shadow relationships under the same light source. Among similar natural lighting algorithm models, the more typical one is the Cook-Torrence BRDF model: $f_r = k_d f_{lambert} + k_s f_{cook-torrance}$ [9], also known as the Lambertian model. The materials under this model algorithm can ensure that animated characters have a good natural lighting effect, suitable for the stylized texture presentation of characters in specific ambient light in the film. k_d represents the ratio of the energy of the diffuse reflected light station to the energy of the incident light, k_s represents the ratio of the energy of the reflected light to the energy of the incident light, and $f_{Lambert}$ is the classic Lambertian diffuse reflection model, and $f_{cook-torrance}$ is the Cook-Torrance specular reflection model. As a very classic diffuse reflection model, the Lambertian model is widely used in computer graphics, with lower computational consumption and better rendering quality. Based on the generation conditions of this algorithm model, the stylized texture map drawn under the camera mapping technology has achieved good light shadow restoration and color restoration.

The unification of light and shadow in the screen is achieved through the matching of materials and image light sources. The mapping of characters in the film is based

Fig. 3. Character map under the camera vs official portrait

on shading in an astigmatic environment (Fig. 3), so its use in most scenes does not affect viewing. Under the influence of a skylight scene or ambient light, the character uses Lambertian material to overlay a layer of stereoscopic light or annular edge light, emphasizing the light shadow relationship with ambient light.

5 Conclusion

The effective intervention of virtual reality technology has developed the human sensory function and improved the all-round emotional experience. The audience's vision has followed the development of technology and stepped into the combination effect of virtual images to experience the narrative wonders. The emotional experience of on-site immersion has been obtained from the spatial immersion of the wonders and the time immersion of perception movement. The embodied practice is the bridge and intermediary between people and the image world. Through technology, people's perceptual experience has changed, and through technology, people's emotional experience has enriched. This embodiment shows the existential relationship between people and the image world. The audience has achieved aesthetic transcendence in the concrete satisfaction of digital reality and the on-site immersion of digital wonders, and has obtained a more real, rich and free emotional experience.

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