

Development of Chinese Animation from the Perspective of Computer Evolution

Namin Mi*, Alexey Sukhov

*School of Art, Xi'an International Studies University, Xi'an 710119, Shaanxi, China
Xi'an Fanyi University, Xi'an 710105, Shaanxi, China
Corresponding author. E-mail: mina198801@163.com

ABSTRACT

To start with the introduction of relevant computer graphic image processing technology, combined with the historical experience of animation in China and abroad, compares and investigates different animation production methods, analyses the influence of computer technology on animation production in depth, introduces the relationship between technology and art, and looks to the future of Chinese animation production.

Keywords: *Computer Technology, Ink Wash Animation, Chinese Animation*

The development of Chinese animation has progressed with the development of science and technology. From the pioneers of Chinese animation, the Wan brothers were working under difficult circumstances, repeatedly drawing on paper and working hard without prior experience to create their first paper animation, then moving into the new era of 3D animation with the release of "Green Snake" in 2021, the development of this road has been significant [1]. It shows that excellent animation production is inseparable from the evolution of computer technology.

China ushered in the first peak in the history of Chinese animation in the 1950s and 1960s. The characteristics of the stages of development were the huge productions of animation, and new film types that continued to emerge. From 1957 to 1965, under the literature and art policy "Let a hundred flowers bloom and a hundred schools of thought contend", were produced different kinds of Art films, that we can see in a table [2]. The most representative new films include ink wash animation, paper-cut animation, origami animation, etc. We will take the production of ink wash animation to discuss the influence of computer technology on animation production.

1. INTRODUCTION OF CHINESE ANIMATION HISTORY

Table 1. Studio Production data

1957-1965 Shanghai Animation Film Studio produced 105 art films				
Cartoons	Puppet films	Paper-cuts cartoons	Origami cartoons	Puppet documentaries
40	37	16	3	9

The introduction of Chinese ink wash animation has had a major influence in the history of world animation. In 1960, "Little Tadpoles Looking for Mother" opened the door to the development of ink wash animation. "Mu Di" was produced in 1963 and was banned for ten years, but when it reappeared in the public eye, the response was marvelous. Later in the 1980s, "The Deer's Bell" and "Feeling of Mountains and Water" laid a solid foundation for the development of ink wash animation [3]. Shanming Wu used to draw more than 100 grandpa's shapes on raw rice paper when he created the character design of "Feeling of Mountains and Water", and finally selected only one of them as the final character setting. During the animation production process, he not only had to control the water and the proportion of the ink, it was necessary to control the ink wash modeling to avoid frame skipping on the basis of

continuity of movement. Even to the present day it still remains a technical difficulty in the production of ink wash animation on paper. Nowadays, with the rapid development of computers, all kinds of animation production software have gradually appeared. For example, the French two-dimensional animation software TVP Animation, in its existing brush library, there are 7 kinds of brushes that simulate ink wash animation, these kinds of brushes not only simulate the simple freehand ink wash painting, but also the proportion of ink and wash techniques. The control is more convenient. The biggest disadvantage is that you can't adjust the brush color, although you can complete the basic drawing of traditional "Chinese brush ink divided into five tones of black color" presented on Figure 1. At the time, we thought that the uncontrollable factors on paper were gradually solved. Although ink

brush strokes can be imitated in two-dimensional animation software, the disadvantage is, it constantly lacks the aura of real ink painting. Perhaps it is the uncontrollable factors on paper that create the agility and reality of ink wash animation.



Figure 1. Chinese brush ink divided into five tones of black color

Then why does the growth of ink wash animation depend on the development of computers?

On the premise that the computer is also used to make ink wash animations, the production of two-dimensional (2D) and three-dimensional animations (3D) have their own advantages and disadvantages. For example, when animators are making a character in motion and the camera is rotated 360 degrees, the camera animation in the 3D animation software can easily replace the frame-by-frame drawing of the 2D animation. Regardless of the moving role in the lens, 3D animation only needs to create a camera, then adjust the position of the lens, and then perform Key frames on the camera on the time bar, but in traditional computer 2D animation production, if you make 3 seconds of camera animation according to the standard of 24 frames per second, 2D animators need to draw 72 separate animation frames, resulting in each picture frame being different, creating dynamic characteristics through different angles in every shot, as the camera rotates 1°, the angle of the scene and the character of the object or subject change accordingly. If you are making a dynamic character in a static shot, 2D animation is much more convenient than 3D animation. 2D animation requires drawing the character animation in the shot directly into the software. The action preview will be instantly produced, further motion edits can be performed. The prerequisite for the production of character animation in 3D is to complete a series of steps such as: modelling, UV texture editor, mapping, binding, and weight brushing. The quality of the model is affected by the quality of UV, texture and weight brush. UV will affect the quality of textures, binding will affect the quality of weights, and weights will affect the quality of actions, if in the creation process of 3D animation, if one step is not done well, it will have an overall effect in the filming process. The K-action is the final component, with these series of linked steps to complete the superior quality production.

However, with the rapid development of computer hardware, and different 3D software has emerged, the resulting picture effects have become more and more realistic and exciting, the audience's expectations have

also increased. We can see the existence of 3D animation everywhere. The full-dimensional visual effects in 3D are incomparable to 2D animation [4].

Shanghai Animation Film Studio has never stopped exploring the development of Chinese animation. It can be seen from the trailer of "Gorge Leaping Gorals" that was posted on the Internet in May 2020, the traditional ink wash animation has benefited a lot from new computer technology. For example, the opening scene in the trailer shows the camera following a soaring eagle through thousands of rocks and mountains. In this scene, there are two parts of animation, the movement of the eagle flying alongside the camera and as if the camera is following the eagle shown on the figure 2. The animation production method they adopt is not the traditional technique of ink wash animation on paper, but it is implemented in the 3D software using "the 3D technique with feeling of 2D animation", the ink map is then pasted on the 3D model to render the two in this way, when the eagle leads the first view camera through the layers of clouds and fog, the audience's visual experience will be more realistic, as if they have entered the real world of ink wash technique, which also solves the difficult problem of drawing ink wash technique shots one by one in production.



Figure 2. Gorge Leaping Gorals

2. THE FUTURE DEVELOPMENT OF CHINESE ANIMATION

Why don't China directly announce that it will no longer produce 2D animations and develop 3D animations, as the United States did in the 1990s?

2.1 Two U.S. Animation Giants Stopped Producing 2D Animations

In 1991, Disney published a 2D animation "Beauty and the Beast". In the film, animators tried to use in several scenes a 3D animation method for the first time, which used 3D animation technology in a 2D animation movie to solve the production of motion shots and large-scale scenes. However, in the final presentation of the screening it was still similar to the 2D effect. After the company published its first 3D animation "Toy Story" in 1995, it announced it would no longer create 2D animations. Dream Works, another major animation company in the United States, produced the "Prince of Egypt" in 1998 [5]. At the beginning of the film, the

animation expression using 3D animation technology in a 2D animation production, 3D was best suited to express the magnificence of Egyptian architecture and some of the motion shots. In the final scene 3D technology was also used to make the animation part of Moses Splitting the Sea. In this animation, it is obvious that 3D animation can not only solve the cumbersome problem of lens movement in 2D animation, but also bring you a more dramatic visual experience [6]. DreamWorks also announced it will no longer produce 2D animation movies following their success. At that time, the two U.S [6]. animation giants jointly released news about stopping production 2D animation, they do it because they were inseparable from the commercial competition between them.

2.2 Chinese Storytelling Under The Premise Of Mixing Technology And Art

Returning to the question, why not just completely eliminate 2D animation in China and make 3D animation? In my opinion, the best method of telling stories will be to combine and utilize 2D and 3D animation in various scenes to express animation styles.

The progress of computer technology must certainly assist the development of animation. Each country's animation has its own characteristics. The Japanese animation development is still dominated by 2D animation. Although "Doraemon: Stand By Me" was made into a 3D animation, its storytelling method, And the design of the styling, so that the audience thinks it is a standard Japanese animation work; As for American animation, although they no longer produce 2D animations, all their 3D productions make the audience think that these works are still typical American animations, as if their storytelling methods and character models use the same template; The emergence of the "Chinese Animation School" can still represent the style and characteristics of China's animation, despite the fact that Disney and DreamWorks produced a series of animated works with Chinese elements, for instance "Coco" and "Kung Fu Panda", but they still cannot replace true Chinese animation. The artistic conception that comes out is only available in China [7].

In the 1960s, the "Chinese Animation School" was recognized by the world not only for its superb production technology, but also for its works of high artistic value. The foundation of their artistic value comes from the "Chinese style", whether it is its storytelling, how to design the shape, and the expression of the picture to reflect the "Chinese style". For example traditional Chinese brush ink divided into five tones, utilize a blank white space in a scene, and ideological conception in ink works, that only the Chinese can better understand the source of its artistic value. It's in Chinese cultural DNA

3. ADVANCED SOFTWARE ASSISTS THE CREATION OF ANIMATIONS

In recent times, with problems facing animation production platforms, and with the advancement of 2D animation and 3D animation software I strongly advocate their use as it provides inspiration during the creative process.

For example, the large number of brush effects in the 2D animation software TVP Animation can not only help designers complete the drawing of dynamic scenes, but also help them explore different animation styles; another example is the Procreate software on the iPad platform, although it is a very small software, it can assist the designer's illustration drawing skills and the production of 2D animation. It may not be considered traditional or very professional software, their layer module is not convenient enough, but is very easy to carry and it solves the animator's problem of making animation at home or in the studio;

Each update of the 3D animation software Maya, not only has certain requirements for computer hardware, but its purpose is to more conveniently serve animators. such as the merger of the Arnold Renderer after Maya 2018, its not necessary to install the Arnold plug-in already. In the previous version of Maya software, there is no Arnold [8]. In order to use the Arnold, many Renderers can only download the plug-in. As far as the rendering effect is concerned, the Arnold rendering effect is indeed more realistic than the Mental ray that came with the previous version of Maya, also the picture quality of its rendering results seems to be dedicated to film and television animation [9].

Furthermore, the scientific nature of software will also provide a lot of inspiration for designers in the creative process. Compared with two-dimensional software, 3d software will be more rational in the creation process, and its final visual effect will be more "realistic". Taking MAYA software as an example and discusses the motion method of simulating and analyzing the movement of tree branches in software combined with relevant knowledge based on Mechanics of Materials.

If a single branch does not consider the other branches, then the movement of beams and poles in Mechanics of Materials can be used to simulate the tree dynamic of a single branch under the wind force. Analysis of its motion inevitably involves force analysis. We take a whole tree as a object, where the stress and dynamics of branches analyzed under the action of a breeze.

Assuming that the branches are subjected to a uniform wind force, and the wind acts on the free end of the branches, a force F_1 is applied to the branches at the first branch, because when the trunk moves in the wind,

the deformation of the trunk will generate a rebound recovery force F_2 . Air resistance is small relative to the force on the trunk, so it is ignored. The free end is subjected to two forces, namely the force F_1 caused by wind and the force F_2 caused by deformation, as shown in the figure 3.

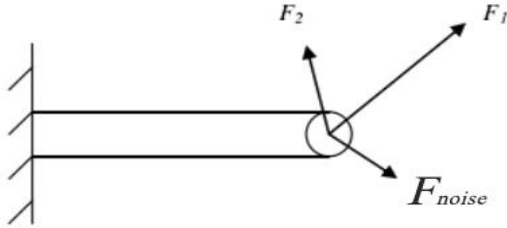


Figure 3. Tree branch joint

Where, force F_2 is calculated by the formula:

$$F_2 = -kF_{old}$$

The above formula reflects some properties of the value, the bent branch tries to move back to its original position. k is a constant, the restoring force coefficient. F_{old} is the force produced by the wind.

Moreover, add noise to the branches to realize the natural swing of the branches. The noise load force F_{noise} is described by the following formula.

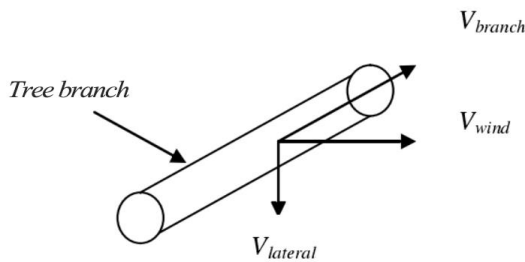


Figure 4. Tree branch mechanics and wind power

$$F_{noise} = k_1 f_1 V_{wind} + k_2 f_2 V_{lateral}$$

$$V_{lateral} = V_{wind} \times V_{branch}$$

$$k_1 = 0.5 - cr_1^1 - (1 - c)r_{ij}^1$$

$$k_2 = 0.5 - cr_1^2 - (1 - c)r_{ij}^2$$

On the figure 4 we can see, V_{wind} is the unit vector of wind direction; V_{branch} is the unit vector of branch direction; F_1 and F_2 are the maximum values of V_{wind} direction and $V_{lateral}$ direction correspondingly. C is a constant used to adjust hardness and density. Experiments have shown that if $C = 1$, the branches move up and down almost uniformly, creating a monotonous and unnatural motion, and better to use parameter in between 0.7 and 0.9. R_{i1} and R_{i2} are the noises of direction V_{wind} and direction $V_{lateral}$ at time correspondingly. r_{ij}^1 and r_{ij}^2 are respectively the noises of

branch J in direction V_{wind} and direction $V_{lateral}$ at time I . All noise is calculated using the Perlin noise function.

The above analysis only calculated when the branches are subjected to wind, followed by the deformation of the branches. If you want to make it more vivid, you can add the analysis of the force on the leaves falling and the force on the branches breaking. Considering the comprehensive force, the model will be more realistic in the Animation module of Maya.

There are countless examples like this, and the relationship between computer and animation is destined to be inseparable. At the same time, it can be seen that the future should be an era in which everyone can create quality animation [10].

4. CONCLUSION AND OUTLOOK

- (1) Over the last two years the Ministry of Education has proposed teaching concepts such as "new liberal arts, new engineering, and new agriculture courses". The goal is to encourage people from all walks of life to incorporate current events and conduct a comprehensive study across all disciplines in order to accomplish knowledge expansion and the fostering of new thinking.

Regarding the development of Chinese animation, I believe that when cultivating talents in animation studies, it is necessary to let the new generation of animators understand that neither technology can solve everything, nor conservative creation, nor abandoning any form of animation, but rather make good use of the appropriate animation style to tell the story.

It is critical to maintain the spirit of the "Chinese Animation School's" previous generation. It is more vital to learn how to understand art than it is to know how to bear adversity and work hard. Chinese legends can only be told successfully if art and technology are truly combined.

REFERENCES

- (3) [1] Davis Edward L. Encyclopedia of Contemporary Chinese Culture. Taylor and Francis, 2004,9, pp.350-390.
- (4) [2] Jigui Bao, General History of Chinese Animation Films, China Fine Arts Publishing House, 2010, 5, pp.130-143.
- [3] Yunjiang Wang, My Humble Opinion on Special Effect Technology in Computer Animation Design and Production. Digital Technology and Application, 2021,1, pp.67-88.
- [4] Lijun Sun, History of Chinese Animation. The Commercial Press, 2018, 8, pp.110-135.

- [5] Stephen Cavalier, *History of World Animation*. Chinese-English Translation Press, 2012, 6, 112-135.
- [6] Meike Uhrig. *Emotion in Animated Films*. Taylor and Francis, 2018, 6, pp.140-180.
- [7] Johnston Andrew R, *Pulses of Abstraction: Episodes from a History of Animation*. Minneapolis; London, University of Minnesota Press, 2011, 4, pp.156-175.
- [8] Michael Ingrassia, *Character Creation for Games and Animation: Professional Techniques with Maya and ZBrush*. Focal Press, 2021, 7, pp.195-215.
- [9] Jamie Cardoso, *3D Photorealistic Rendering: Interiors & Exteriors with mental ray and 3ds Max*. A K Peters, 2016, 11, pp.58-75.
- [10] Magesh Chandramouli, *3D Modeling & Animation: A Primer*. CRC Press, 2017, 5, pp.13-38.