

On Computer 3D Animation Production Technology: Postprint

Authors: Kong Xiangpeng

Date: 2023-10-08T00:00:00+00:00

Abstract

With the rapid development of science and technology, various technological means emerge incessantly. The advancement of diverse computer technologies has enabled extensive application of 3D animation technology. This technological form of expression is ubiquitous in people's daily lives; however, most individuals possess limited understanding of the specific content of this technology, and some are even unaware of its full name. This article commences with the concept of computer 3D animation production technology and introduces its various classifications, aiming to facilitate comprehension and contemplation regarding the specific manifestations of this technology and its applications in everyday life.

Full Text

A Brief Discussion on Computer 3D Animation Production Technology

Author: Kong Xiangpeng

Journal: ChinaXiv Cooperative Journal

DOI: 10.19483/j.cnki.11-4653/n.2018.03.016

Abstract

With the rapid development of science and technology, various technological methods have emerged incessantly. The advancement of computer technologies has enabled 3D animation technology to gain widespread application. This technological form of expression can be seen everywhere in daily life, yet most people do not fully understand its specific content or even know its complete name. This article begins with the concept of computer 3D animation production technology, introduces its various classifications, and aims to provide

readers with a deeper understanding and reflection on the specific manifestations and applications of this technology in everyday life.

Keywords: 3D animation technology; character animation; production technology

Classification Code: TP391

Document Code: A

Article ID: 1671-0134(2018)03-040-02

Many years ago, the fully 3D-animated film *Toy Story* captivated global audiences with its vivid characters, lifelike visuals, and remarkably realistic movements, establishing 3D animation technology's reputation worldwide. Many perceive 3D animation as magical and mysterious, lacking concrete understanding of its technical specifics. This article analyzes the essence of computer 3D technology, provides a comprehensive overview through five classification types, and explores future applications and extensions of this technology in daily life.

1. Concept of Computer 3D Animation Technology

Computer 3D animation leverages the persistence of vision characteristic in human perception. By rapidly playing a series of static images, it creates dynamic visual effects that form “moving” pictures. Computer 3D animation combines scenery with computer software to render three-dimensional images, where each frame is a slight modification of the previous one. The production process requires coordination between computer graphics systems and corresponding animation software on computers—only when the images “move” does the animation achieve its essential success. This technology already featured numerous production software packages in the 1970s, and although these programs differed in external appearance and functionality, they all operated on the same fundamental principles for animation production [?].

2. Classification of 3D Animation Technologies

2.1 Geometric Transformation Animation

Geometric transformation animation, also known as “rigid body animation,” operates based on geometric properties to perform various displacement and transformation operations on images, creating dynamic effects by linking them together. Its specific characteristic is that it does not destroy the image itself but rather achieves animation through changes in size and position within a scene. In geometric animation production, keyframe technology is typically employed, a method originating from traditional animation. In traditional animation, key content was designed by skilled artists, while ordinary designers created the in-between frames. In 3D animation production, however, the computer software handles the non-key content, leaving only the key portions for designers to control, often utilizing geometric transformation animation techniques.

2.2 Deformation Animation

Scenes typically contain numerous nodes, and altering these nodes causes significant changes to the image. Deformation animation is precisely a technique that modifies the sequential arrangement of these nodes. In the past, when technology was less mature, animators had to employ exaggerated forms to express character traits, resulting in highly stylized visuals. In today's technologically advanced era, 3D animation technology enables character forms to be based on sufficient expressive capabilities, allowing more vivid demonstrations of facial expressions and movement characteristics. This technology explores deformation by modifying parameters and polygonal surfaces, making deformation animation appear more dynamic in 3D animation [?].

2.3 Character Animation

Character animation represents the most challenging aspect of 3D animation, fundamentally involving the anthropomorphic portrayal of animals, people, and cartoon characters based on human body modeling. The human body can perform over 200 simultaneous and highly complex movements, with muscle manifestations varying considerably and transforming accordingly during activity. Facial expressions can assume countless forms depending on psychological states. Consequently, character animation based on the human body becomes extremely difficult. However, technicians have risen to the challenge by separating the production of body and facial components, assigning different technical departments to specialize in researching expressions and related body movements.

2.4 Camera Animation

Camera animation, also referred to as lens animation, enriches animation effects by manipulating camera position, distance, and shaking. This technique is commonly employed in architectural construction processes, requiring practitioners to maximize shot stability while highlighting key visuals. The camera serves as the creator's eye, and the speed and coverage of scene capture depend on the camera's internal structure and actual frame rate. Creators must consider how to faithfully reproduce recorded environments within the camera. For abstract scenes such as astronomical galaxies, four-dimensional spaces, and particle structures that cannot be observed in everyday settings, 3D animation technology can effectively demonstrate these effects. Although this animation technique represents an indirect means of simulating reality, it is frequently applied in virtual reality animation [?].

2.5 Particle System Animation

Particle system technology in animation typically simulates phenomena such as light, shadow, rain, snow, and lightning. Traditional animation techniques

lacked such realistic capabilities, but contemporary technology sufficiently supports particle system development. This technology employs sophisticated algorithms to automatically generate scene representations within the image, incorporating statistical data on cycle speed and other parameters into its computational framework. After system integration and design, creators can conveniently adjust the degree, intensity, and scale of special effects.

3. Relationship with Traditional Animation

3.1 Comparison with Traditional Animation Technology

Traditional animation techniques required designers to draw on paper, manifesting various human expressions through manual depiction before copying them onto cels to create animation. Human body movements are numerous, and facial expressions infinitely varied, making it difficult to capture expressive nuances through illustration alone. Consequently, traditional animation often employed exaggerated techniques. As a product of the new technological era, 3D animation is computer software-based. Compared to traditional techniques where creators relied on extreme imagination and creativity while painstakingly drawing images, contemporary computer animation no longer requires designers to exhaustively demonstrate expressions on paper. Instead, it utilizes new technologies to simulate human expressions and postures, producing more realistic effects. This represents an improvement and update based on traditional animation production, significantly accelerating production progress while achieving effects more closely aligned with real life [?].

3.2 Integration with Traditional Animation Technology

In current 3D animation technology innovations, creators have moved away from hand-drawn components, liberating labor while achieving updates and improvements to traditional techniques. However, traditional animation production retains its special advantage in artistic expression. Designers' rich imagination infused into animation production can make characters more expressive and distinctive—qualities that current 3D animation technology cannot replace or transform. Combining both approaches would hold significant meaning for the development of animation production.

3.3 The Integration of Technology and Art in Computer Animation

Based on mathematical geometric content, aesthetics, and cinematography, computer animation technology continuously updates and develops itself through computer software development, primarily achieving broad development space through film and television. Due to rapid technological advancement, computer software development has greatly accelerated the animation production process. Mathematics, as an abstract discipline, provides new ideas for animation production through theoretical knowledge applied in practice, gradually maturing the technology [?]. In contemporary society, the value of computer animation

technology has become increasingly evident, encompassing not only practical value in daily life but also considerable economic value and rich artistic value. During animation production, mastery of basic art fundamentals represents the most fundamental requirement for creators, enabling unlimited imagination and more vivid, expressive animation demonstrations. Through the combination of technology and art, computer animation can achieve more prominent three-dimensional manifestations, presenting audiences with optimal visual effects.

References

- [?] Wang Wei. Analysis of Key Technologies in 3D Character Animation Production[J]. Popular Literature and Art, 2015(18): 128.
- [?] Liu Yang, Guo Yingfei. Discussion on Key Technologies in 3D Character Animation Production[J]. Industrial Design, 2016(08): 188+190.
- [?] Wang Xiao. Application of Virtual Reality Technology in 3D Animation Production[J]. Information and Computer (Theoretical Edition), 2017(02): 86-87.
- [?] Feng Yang. Discussion on 3D Modeling Technology in 3D Animation Production[J]. Journal of Shangqiu Vocational and Technical College, 2013, 12(05): 27-28.
- [?] Lu Tian. Discussion on Several Understandings of 3D Animation Production Technology[J]. Silicon Valley, 2010(05): 60.

(Author's Affiliation: Jiuquan Satellite Launch Center Television Station)

Note: Figure translations are in progress. See original paper for figures.

Source: ChinaXiv — Machine translation. Verify with original.