

Exploration of Digital Application of Ink Painting Techniques

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Abstract: Although ink-wash animation, as the most distinctive national feature in the history of Chinese animation, has long been constrained by technical challenges in production. With technological advancements, these technical difficulties have finally been resolved, and ink-wash animation will ultimately break through its bottleneck, captivating audiences both domestically and internationally with its uniquely Chinese charm. This paper explores the feasibility of applying Chinese ink-wash painting techniques to 3D animation design through the development of digital technology and self-practice.

Keywords: Ink; Animation; Technique; Digitization.

1. Introduction

Ink wash animation first emerged in the 1960s, pioneering a new genre in animation history. While achieving remarkable success initially, it faced mounting challenges including complex production techniques, lengthy development cycles, high costs, and a shortage of skilled personnel. These issues plunged the art form into developmental stagnation. The key challenge now lies in finding viable survival strategies within this challenging environment. However, advancements in technology, government support, and public enthusiasm for traditional culture are bringing renewed hope. With growing audience engagement, this artistic genre is poised to break through current constraints and achieve a revitalized rebirth.

With the advancement of technology, the integration of traditional ink-wash animation with computer digital techniques has produced numerous outstanding works. Even international animations now frequently borrow effects from this art form. This paper examines the evolution of ink-wash animation through historical analysis, technical development studies, and market demands. By exploring breakthroughs in digital ink-wash animation technology and industry growth, it combines the author's practical experience with digital ink-wash techniques to chart the future direction of this artistic medium.

2. The Development of Contemporary Digital Ink Animation

2.1. The Digital Origin and Status of Ink Painting Animation

Ink painting plays an important role in the long river of Chinese art, which combines the advantages of ink painting and animation. With the wide application of digital technology, computers have replaced most manual production, which provides the possibility for the new development of ink painting.

2.1.1. Development Overview of Ink Painting Animation

The earliest batch of animated works in China were produced after the founding of the People's Republic. However, due to imitating the Soviet animation development model, there were many shortcomings. Therefore, the

Chinese people resolved to create animations that belonged to China. In the 1960s, ink-wash animation could be regarded as a major innovation in Chinese animation. It introduced traditional Chinese ink-wash painting into animation production, and the subtle atmosphere and graceful, elegant visuals achieved a significant breakthrough in the artistic style of animated films [1]. From the 1960s to the 1980s, Shanghai Animation Film Studio produced a series of excellent ink-wash animations, each with its own unique characteristics and merits, becoming unforgettable childhood memories for many.

Chinese ink painting is a unique existence with Chinese characteristics. Ink animation is rooted in the millennium-old traditional art of Chinese ink painting. It uses Chinese ink painting techniques as the means to depict human figures and environmental spaces, employing special filming techniques to capture each image and composition of ink paintings one by one. Through continuous projection, it forms animated films featuring dynamic ink paintings with varying shades and spatial arrangements [2]. From "Little Tadpoles Looking for Mom" to "Affection for Mountains and Waters", the older generation of animators have created one animation miracle after another with boundless imagination and creativity. The lively brushwork carries the beautiful memories of generations and has left an invaluable mark in the history of world animation.

2.1.2. Limitations and Decline

Traditional Chinese ink-wash animated films have safeguarded the new path of China's animation art, which is imbued with national characteristics. Ink-wash has always held a high status in the history of Chinese animation. However, since the 1990s, the ink-wash animations we once took pride in have almost vanished from the scene. The production time required for a single ordinary ink-wash animation could shoot four to five regular animated films of similar length. Yet issues such as lengthy production cycles, high costs, lack of substantial funding and creative teams, complex manufacturing processes, and shortage of professional talent remain unresolved. Apart from some promotional videos and short advertisements, ink-wash animations were virtually forgotten for a time. Thus, the once globally sensational ink-wash animations gradually declined.

2.1.3. The Development of Digital Technology for Ink-Wash Animation

In the early 20th century, the emergence of "Peach Blossom Spring" in 2006 caused another sensation. However, unlike traditional ink-wash animation, the entire animation was completed with computer technology. Technology enabled ink-wash animation to break through its limitations and revived traditional culture.

Similarly, in 2009, CCTV produced a series of impactful ink-wash short films titled "Believe in the Power of Brands." These visually stunning works left a profound impression on audiences, significantly boosting the enthusiasm of production and development teams. During this period, ink-wash animations increasingly leveraged computer technology to drive innovation, effectively overcoming traditional limitations such as complex craftsmanship and lengthy production cycles.

2.2. Breakthrough of Digital Ink-Wash Animation in the Digital Era

Nowadays, after years of dormancy, has the once sensational ink-wash animation truly lost its vitality as a work that embodies the collective efforts of generations of Chinese animators? Can this uniquely national art form really not compete with foreign animations? With the advancement of modern technology, can it provide more possibilities for ink-wash animation? This analysis addresses these questions by examining the digital application and exploration of contemporary ink-wash techniques.

2.2.1. Technical Support for Breakthrough in Ink Painting

With the popularization and development of computer technology, other forms of animation have been exploring shortcuts to utilize computer technology in animation production. In China, the ink-wash animation production process is particularly unique. Initially, computer simulations of ink-wash effects were not ideal. It wasn't until the 21st century that digital technology became increasingly mature, making the simulation of ink-wash effects more realistic, and designers began to pay greater attention to this new art form. Meanwhile, every aspect of people's lives has entered the digital age. In the 21st century, we have fully adapted to the digital era. In this new world, by using computer-generated digital effects to replace traditional brushwork and ink techniques, and through digital technology achieving the modeling, shading, and negative space effects of ink-wash paintings, the application of digital technology allows ink-wash art to transcend paper limitations. Today's ink-wash animations are presented to the public in a more modern manner.

Contemporary designers have been actively exploring the use of computer technology to create ink-wash animations. The defining feature of the digital age lies in the comprehensive integration of computer technologies, which enables full digitalization of traditional ink-wash painting techniques. This advancement allows production processes to fully embrace a paperless animation era, significantly reducing development time. Consequently, to enhance the quality of ink-wash animations, digital technologies must also undergo continuous development and refinement.

2.2.2. Objective Demand of Digital Ink-Wash Animation

Ink-wash animation embodies China's unique national style, but it has not yet gained widespread popularity as it

remains in its early developmental stage. Especially in this era of rapid technological and information advancement, the Chinese market has introduced a large number of foreign animations, which has brought significant challenges to the development of traditional Chinese ink-wash animation. There is an urgent need to develop and showcase local-style animation forms. The technical difficulties in traditional ink-wash animation production and the current state of China's animation market require digital ink-wash animation to continue evolving.

Identify the limitations in the development of ink-wash animation, and on this basis, utilize technology to promote its further development, exploring the path of growth and popularization of ink-wash animation. At the same time, emphasizing the development of ink-wash animation is not only a requirement for national cultural characteristics but also a symbol of China's animation entering the international stage.

3. The Application and Industrial Development of Ink Painting Animation In 3D Animation

The application of digital animation technology can present a rich and colorful ink-wash world, bringing traditional Chinese ink painting to life through modern animation production. This approach better showcases the techniques and effects of traditional Chinese ink painting, achieving a perfect integration of technology and art. It also represents the collision between modern technological development and traditional Chinese culture.

3.1. The Feasibility of Applying the Effect of Chinese Ink Painting in 3D Animation Design

From the successful experiments of some digital 3D ink-wash animations at this stage, we can see that combining ink-wash style with 3D animation technology not only saves costs and eliminates the traditional techniques required for animation production in the past, where repeated shooting and special processing were necessary to make images move, but also integrates with modern animation technologies, providing a new direction for the development of ink-wash animation. The influence of ink-wash animation on 3D film special effects. The unique shading and gradient effects of ink-wash animation impose higher requirements on graphic rendering. In the production of ink-wash animations, edge treatment primarily utilizes lines, while internal transitions rely more on blended materials [3] Shi Qi. Research on the Application of Traditional Chinese Ink-Wash Style in 3D Animated Films [J]. Film Literature, 2007, (20):97-98. From an artistic perspective, 3D ink-wash animation not only expands the spatial expression of ink-wash painting but also achieves the effects of traditional Chinese ink-wash painting techniques. Additionally, through camera manipulation methods, viewers can immerse themselves in the virtual-realistic ambiance of ink-wash paintings, experiencing their vivid charm and evoking boundless emotions—a significant breakthrough in Chinese animation. Technically speaking, by employing various methods in 3D animation software, digital ink-wash animations with distinctive Chinese traditional ink-wash characteristics can be created after rendering ink-wash effects.

3.2. Application of Ink and Water in 3D Animation Production

By combining the characteristics of traditional Chinese ink animation and 3D animation, this paper demonstrates the influence of ink animation on 3D animation from aspects such as story plots, character images, special effects, texture composition, etc.

3.2.1. The Characteristics of Traditional Chinese Ink Animation Combined with the Characteristics of 3D Film and Television Animation

The brushwork of traditional Chinese ink painting is delicate and rich in artistic conception, where even a simple ink painting contains abundant dramatic elements. For instance, in the spatial treatment of Chinese painting, one first creates a water surface with stones, trees, grass, etc. In Western paintings, the water surface is typically a solid entity featuring color, ripples, reflections, and inverted images. However, if all these elements were fully rendered during the production of ink animation, it would lose the unique aesthetic appeal of Chinese painting. Therefore, the project team omitted the colors, ripples, and reflections on the water surface, transforming it into vast blank areas within the composition. The spatial depth and texture of the water are conveyed solely through reflections and their undulations, leaving ample room for imagination. [4] Moreover, such extensive blankness does not render the image monotonous, as Chinese painting favors highly condensed compositions that express the artist's ideas through more subtle artistic conceptions. The ink rendering artistry of Chinese ink animation is also characterized by its rich texture, which remains an essential aspect to preserve and develop when converting Chinese ink animation into 3D animation.

3.2.2. The Influence of Ink Style on 3D Animation Story Design

Ink painting animation can convey a complete story, but in terms of content and subject matter selection, the distinct and intense Eastern characteristics of ink animation are not suitable for European or American stories, but can be used to depict some plots with Chinese characteristics.

3.2.3. The Influence of Ink Painting Form on 3D Animation Character Design

Compared to other animation techniques, ink-wash animation emphasizes expressing character movements primarily through line contours. In conventional animation, depicting hand movements might rely on light and shadow angles without explicit contour lines. However, ink-wash animation employs a distinct approach: it requires adding contour lines around body parts to define forms. The dynamic interplay of lines and their movement constitutes the essential artistic expression in this style. Consequently, character design in ink-wash animation resembles sketching or line drawings rather than oil paintings or watercolors [5].

3.2.4. The Influence of Ink Painting Special Effects on 3D Film and Television Animation Special Effects

The ink wash technique's inherent ambiguity and gradation effects demand superior rendering capabilities. When creating animations, distinct approaches are required for object edges versus interiors: external details employ linear outlines while internal elements utilize subtle shading. This methodology unlocks new possibilities for developing ink animation special effects. Consider a water droplet: while conventional animation uses realistic splashes to depict falling water, ink

animation transforms this into stylized ink dots that defy literal representation. Similarly, death scenes differ dramatically – whereas traditional animation might show characters bleeding and collapsing, ink animation uses ink blotches and vanishing characters to convey life's end. Achieving these visual effects requires not only profound mastery of ink painting techniques but also the creator's boundless imagination.

3.2.5. Application of Ink Texture and Composition in 3D Film and Television Animation

First is the three-dimensional scene composition, which requires arranging the lens density according to the artistic conception and paying attention to the characteristics of scattered-point perspective in ink painting. Not only landscapes can have suitable ink paintings; otherwise, the essential atmosphere and artistic conception of Chinese ink painting would be lost.

Secondly, ink painting emphasizes employing techniques tailored to varying moisture levels and material textures. For instance, the Fei Bai technique (a dry brushstroke technique) is often used to depict relatively hard and dry objects like rocks and withered trees. However, applying this effect in 3D animation can easily result in issues such as glare. Therefore, the application of ink painting style in 3D animation doesn't require a direct replication of all its elements, but rather demands flexible adaptations by film and animation designers.

Finally, in the creation of ink-wash animation, attention should also be paid to the choice of music style, the skillful use of software and the texture composition of the picture, so as to show more possibilities of ink-wash and the unity of Chinese painting. We should not blindly pursue and imitate foreign animations.

3.3. The Coordination of Art and Technology in the Industrial Development of Ink Painting Animation

The development of ink painting animation industry is inseparable from the mutual coordination and common promotion of art and technology. The influence of technological development is not only in artistic creation, but also plays a role in promoting national cultural soft power, cultural and creative products and market development.

3.3.1. The Influence of Scientific and Technological Development on Artistic Creation

The development of all aspects of human society is inseparable from the progress of science and technology, and art is no exception. Although the field of art has never stopped progressing, the role of scientific and technological change is more huge and obvious.

Artists can harness the power of technology in their creative process, making artistic creation more accessible and conducive to innovation. Meanwhile, artists within society at large are also guiding artistic innovation through their personal perspectives. Taking ink-wash animation as an example, the digitalization of this art form has been accelerating steadily. In the new century, attempts to create ink-wash animations using computer technology have become an irreversible trend.

3.3.2. Digital Technology Promotes the Development of National Cultural Soft Power

The integration of technology and culture can foster the emergence of new cultural industries and significantly

enhance talent attraction. Historically, technological advancements have driven artistic innovation and cultural industry development, while in turn, these creative endeavors and cultural sectors require robust technological support to thrive.

Currently, cultural technology innovation has become one of the new engines driving China's cultural industry to achieve leapfrog development. The cultural sector must not only meet the public's cultural needs but also drive national industrial transformation through its structural evolution. The integration of science and art can effectively support related industries and their derivatives, while also contributing to the dissemination of traditional culture, thereby strengthening the nation's cultural soft power.

With the development of digital ink animation, we have witnessed the interaction and collision between traditional cultural industries and technology. The innovative presentation and expression methods have also made the inheritance of China's traditional culture more robust. It can be imagined that as new technologies such as artificial intelligence and virtual reality continue to mature, we will witness the cultural industry constantly renewing and upgrading through technological integration.

3.3.3. The Integration of Digital Ink-Wash Animation Products with Cultural and Creative Products and The Market

Ink-wash animation derivatives not only help mainstream ordinary products into the mass market but also expand their consumer reach. These creative extensions further enhance the products' appeal through innovative approaches. The essence of such derivatives lies in capturing the core elements of the original animations — storylines, characters, and emotional depth — while seamlessly integrating ink-wash techniques with dynamic visual effects to achieve a harmonious blend of artistic expression and modern functionality.

Unlike ink wash paintings, ink animation art focuses on expressing dramatic and emotionally charged ink wash expressions. To keep up with the times, derivatives of ink animation should innovate promptly. In product design, we can highlight the dynamic characteristics of ink animation more effectively. This approach not only utilizes visual language to depict motion effects but also integrates cutting-edge technologies to combine dynamic ink effects with product functionality.

4. The Creative Practice of Digital Ink-Wash Animation "Tomorrow Will be Better"

Inheriting the love for China's traditional ink culture and the application of scientific and technological development, the artistic creation of this work "Tomorrow Will Be Better" employs a combination of ink techniques and digital technology to showcase aspects of the pandemic while expressing hopeful emotional expressions about the future of ink animation.

4.1. Graphic Design and Creative Conception

This creative work not only stays grounded in real-world events and social issues while addressing pandemic concerns, but also showcases the distinctive characteristics of ink-wash animation. Technically, it fully leverages digital formats

characteristic of this art form. Notably, the artist has made bold attempts in visual language, achieving significant breakthroughs both in formal aesthetics and technical execution.

Appropriate color, suitable music, picture composition and character selection not only retain the artistic conception of traditional ink animation, but also conform to contemporary ink technology. In my personal creation, the integration of "traditional" and "contemporary" is also my goal.

4.2. Summarize the Use of Digital Ink Technique in the Work

With the development of technology, ink-wash animation, as one of the important forms in the history of Chinese animation, has also been making continuous progress. The integration of ink-wash techniques with modern technology has enabled traditional Chinese ink-wash animation to find new directions for development. The application of digital technology in traditional ink-wash animation not only improves work efficiency but also reduces production costs, enriches traditional ink-wash animation resources, and plays a significant role in the inheritance and development of traditional Chinese ink-wash art.

Nowadays, ink-wash animation is no longer a simple way to make special treatment and then make animation, but to combine emerging digital technology to explore new ink-wash techniques, which not only enriches our visual experience, but also provides a new form of expression for ink-wash art.

My creative process and post-production workflow can be distilled into three key phases: First, acquiring expertise in ink-wash animation techniques, crafting storylines and character designs that embody this artistic style while maintaining traditional composition and textural authenticity. Second, after completing preliminary work, I utilize computer technology to refine and select essential "visual assets" that ensure cohesive pacing throughout the production, often down to the intricate details of individual flowers and objects. Finally, through technical integration with digital reconstruction, we achieve seamless transitions between concrete forms and abstract concepts. The powerful capabilities of computer technology enable this transformative process, which fundamentally distinguishes "digital ink-wash animation" from traditional ink-wash works. Through these practical explorations of animation techniques, I seek to uncover new possibilities for the millennia-old ink-wash culture.

5. Conclusion

Starting from the development of ink-wash animation, this paper learns from the history of ink-wash animation and digital ink-wash animation techniques. Based on this, the development of digital ink-wash animation is preliminarily explored and the practical application of digital techniques is carried out.

First of all, the limitations and reasons for the decline of traditional ink-wash animation are studied. It is found that the problems such as long production time, high cost and lack of talents can be basically solved on the basis of modern education and technological development. What is more difficult is the popularization of effect production software of ink-wash animation.

Secondly, this paper understands and discusses the new

application of ink painting animation and the development of ink painting cultural industry. The feasibility and shortcomings of the various influences of ink painting animation on 3D animation as well as the coordination between technology and art are analyzed.

Finally, taking my design "Tomorrow Will Be Better" as an example, I integrated the scientific and technological elements mentioned above with ink art techniques. By applying ink painting theories in practical creation processes, I gained substantial understanding of ink animation and its industry through extensive study of ink art knowledge combined with computer operation practices.

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