Cultural Identity in the Deep Sea (2023): A Study of "Particle Ink Painting" Technology in Chinese Animation

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Abstract. This essay examines the role of cultural identity in the 2023 animated film "The Deep Sea," which employs the innovative "particle ink painting" technology. The study investigates the connections between cultural identity, Chinese animation technology, and ink painting technology, highlighting the importance of maintaining cultural identity through advanced technological mediums. Utilizing a qualitative research methodology, the essay analyzes the film and its techniques, ultimately concluding that "particle ink painting" technique in "Deep Sea" provides a novel aesthetic, its limitations underscore the importance of ensuring that technological advances in animation should not only offer visual appeal but also seamlessly integrate with the storyline and character development.

Keywords: Cultural Identity, Chinese Animation Technology, Ink Painting Technology.

1 Introduction

Under the influence of globalization, mainstream animation film techniques are divided into two categories. The most prevalent technique in American animated films is 3D computer-generated imagery (CGI) animation such as Frozen II (2019), Soul (2020), Encanto (2021) and major studios such as Disney, Pixar, and DreamWorks have continued to refine and advance 3D animation, showcasing improvements in charactor rigging, textures, lighting, and rendering techniques. And another animation techniques is 2D hand-drawn led by Japan. Such as Demon Slayer: Mugen Train (2020) Belle (2021) and The Deer King (2022) These animated films rely heavily on 2D hand-drawn animation, while increasingly incorporating digital effects and experimenting with 3D CGI and hybrid animation techniques. Chinese animated films have shown significant growth and diversification in animation techniques and styles. Such as 3D computer-generated imagery (CGI) animation has become increasingly popular in Chinese animated films. For example Ne Zha (2019), Jiang Ziya (2020), New Gods: Nezha Reborn (2021) and also, 2D Hand-drawn Animation, Snimated films like "Big Fish & Begonia" (2016), The King's Avatar: For the Glory (2019) showcase the beauty of traditional 2D animation, often combined with digital coloring and compositing

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techniques. These animated films often incorporate elements of traditional Chinese culture, folklore, and mythology into their visual styles and storytelling. which combine modern animation techniques with Chinese art styles, architecture, and cultural references.

Over the past five years, Chinese animated films have shown a growing trend towards 3D CGI animation while preserving the significance of 2D hand-drawn animation. These films frequently integrate cultural aspects and exhibit distinctive visual styles, reflecting the ingenuity and cultural identity inherent in Chinese animation. Nevertheless, despite excelling in areas like story creation and scene design, Chinese animation continues to predominantly focus on 3D CGI and 2D hand-drawn techniques.

Until Deep Sea (2023) raised the bar for animation technology, attempting to explore a unique 3D animation form that belongs solely to China [1]. It is an animated film that utilizes the groundbreaking "particle ink painting" technology, which merges traditional Chinese ink painting techniques with modern animation technology. This study explores the cultural identity aspects of the film and the technology, focusing on the significance of preserving and enhancing Chinese cultural identity through innovative animation methods.

1.1 Background study

Chinese animation has a rich history that dates back to the early 20th century, with traditional ink painting playing a vital role in its development. Ink painting is an ancient art form that has evolved over the centuries, and its integration into modern animation technology represents a significant milestone in the animation industry. After the introduction of Western animation to China, it blended with the nation's unique artistic forms, and Chinese ink-wash painting animation is considered to effectively represent the essence of Chinese culture. Combining ink-wash animation with storytelling can better disseminate traditional Chinese culture, and ink-wash painting animation is also regarded as a symbol of Chinese culture [2][3][4]. However, with the development of the market economy and the influence of various external factors, ink-wash animation gradually faded from people's view in the 1990s, entering a period of decline. In the modern age, Chinese ink-wash animation has evolved significantly with the advancement of technology. The integration of traditional ink-wash techniques with contemporary digital tools has enabled artists to create more captivating and intricate animations while preserving the essence of Chinese culture.

Chinese ink-wash animation can be divided into two periods: one is the traditional aesthetics period, and the other is the modern technology-driven 3D ink period. Representative works of the traditional aesthetics period include: In 1960, "The Little Tadpole Searching for its Mother" was inspired by Qi Baishi's masterpieces "Frog Sounds Emerge from Mountain Springs," "Little Chick," and "Ink Shrimp"; in 1963, China's first color ink animation "The Shepherd's Flute" was based on landscape master

Li Keran's famous painting "Shepherd Boy and Ox"; in 1982, the ink animated film "The Deer's Bell" was created; in 1983, "The Fight between the Snipe and the Clam"; and in 1988, "The Love of Mountains and Rivers,"…

During this stage, ink-wash animation fulfilled its mission of showcasing China's unique national culture and art. The pursuits of ink-wash animation artists were fundamentally aligned with the aesthetic appreciation of ink-wash paintings.[5][6].

For the modern technology-driven 3D ink period for example: China's first three-dimensional animated short film "Summer" 2003 a computer 3D technology to show the world of traditional Chinese aesthetics. In 2009, "Believe in the Power of the Brand" was the first to use a particle system in 3D technology to simulate ink-wash effects. In 2011, the ink-wash animated short "The Drunken Concubine" was adapted from a classic scene in Peking Opera master Mei Lanfang's performance, showcasing a perfect fusion and innovation between Peking Opera and ink-wash animation. In 2018, the world's first 8K 3D ink-wash animation short film "Autumn Fruits" told an original story through its protagonist, combining meticulous and freehand techniques with 8K technology to create a modern expression. It pioneered a new style and philosophy in Chinese animation, further enhancing the appeal of animation and film in the new era, while attempting to establish new standards for China's future 8K digital film industry and digital research. In 2019, "White Snake: The Origin" used ink-wash not as the main artistic tone but as an element to better express the artistic conception. By 2023, "Deep Sea" became the first to combine ink-wash with three-dimensional innovation.

During this stage of 3D ink-wash animated short films, creators constantly explored new approaches in terms of subject matter, artistic style, and aesthetic pursuits. As they returned to the mindset of film and television art, ink-wash animation gradually shifted from initially focusing on technical exploration and maturity to adhering to pursuing the establishment of conflicts within stories [7].

Under the influence of contemporary art, digital ink-wash animation naturally possesses a stronger experimental nature. Materials, techniques, motion styles, artistic styles, narratives, production processes, subjects, and concepts - every aspect can be transformed through digital ink-wash, greatly expanding the expressive space of ink-wash animation[8]. Digital ink-wash breaks away from traditional ink-wash animation's mindset, transcending the steadfast pursuit of traditional ink-wash painting aesthetics by artists. This is an inevitable trend when modern technology encounters traditional aesthetic culture.

2 Literature Review

Globalization is influenced and dominated by economic, political, cultural, and technological factors[9][10][11].

After 1993, the Chinese animation market opened up, with the government no longer restricting production and cancelling government purchases [12][13]. This change led

to two major challenges for the domestic animation industry. Firstly, foreign animated films could now enter the Chinese market without restrictions, while the production of Chinese animated films remained limited. Original works were mainly short films, suitable for the planned economy, and the vast market demand could not be met. However, the animation industries in the United States and Japan had developed for 20 years, far more mature and abundant than China's, creating a stark contrast and putting the Chinese animation industry at a significant disadvantage. Secondly, there was no real market for domestic animation sales. Television stations held a monopoly, and there was only one price for sales. Facing such enormous consumption potential, the domestic industry failed to form a competitive market on its own. This disadvantage also led to a significant portion of talent flowing into the processing and production sector instead of original content creation [14][15][16][17][18][19][20].

Year	Policy	Representative Animation
1926-1956	1932 "January 28th Incident" - Historical materials of Shanghai animation were destroyed. August 15, 1945 - Japan unconditionally surrendered, marking the victory of China's 14-year resistance war. October 1, 1949 - The founding of the People's Republic of China. 1945-1954 - In the early days of the establishment of the People's Republic of China, the Ministry of Culture explicitly set the policy that "art films should serve children".	1926 "Uproar in the Studio" - The first animation in China. 1935 The first sound animation in China, "Camel Dance", was developed. 1941 "Princess Iron Fan" - The first animated feature film in Asia. 1947 "Emperor's Dream" - The first puppet film in China. 1955 "Why is the Crow Black?" - The first color animation in China.
1956-1966	1956 Chairman Mao proposed the policy of "Letting a Hundred Flowers Bloom" in art and encouraging "A Hundred Schools of Thought to Contend" in academia. 1957 The establishment of Shanghai Animation Film Studio marked the inception of the Chinese School of Animation.	1956 "The Proud General" - A pioneering work of the Chinese school, widely acclaimed in the international animation industry. 1958 "Pig Bajie Eats a Watermelon" - The first Chinese paper-cut animation. 1960 "Little Tadpoles Looking for Their Mama" - The first Chinese Ink-Wash Paintings animation. 1960 "The Clever Duck" - The first Chinese origami animation. 1963 "The Shepherd's Flute" - Ink-Wash Paintings animation.
1966-1976	Cultural Revolution	

1976-1995	In 1978, the national government approved the then Shanghai Television Factory, now known as Shanghai Media Group, to import the first color TV production line from abroad. In 1982, with the completion and commencement of production and the improvement in living conditions, more and more urban and rural residents started purchasing color televisions. Henceforth, color television entered the stage of popularization in China.	1979 "Nezha Conquers the Dragon King" - China's first large-scale color wide-screen animation feature film. 1982 "The Deer's Bell" - A classic ink and wash animation, often referred to as the "living fossil" of Chinese ink and wash animation. 1986 "Calabash Brothers" - One of the representative works from the second boom period of Chinese animation. In 1988, "Feelings of Mountains and Waters" the last art masterpiece before the complete commercialization of Chinese animation. Since then, Chinese animation has moved further and further down the path of targeting younger audiences and subsequently commercializing.
1995-2004	In 1995, China abolished the planned policy of unified purchase and distribution for animations, pushing Chinese art films fully into the market.	1999 "Lotus Lantern" - This animation utilized computer-generated 3D special effects, marking an epoch-making significance in the production of domestic animated films in China. 2001 "I'm Crazy for the Song" - The first Chinese animation with a campus music theme.
2004-2012	After 2004, support policies for original animations were introduced in succession, providing strong support for domestic animation through tax benefits and subsidies.	2011 " Kuiba " 2012 "Boonie Bears" - China's first animated film on the theme of forest protection.
2012-now	In 2012, the "Twelfth Five-Year Plan for the Development of the National Animation Industry" established the basic approach and main goals for the development of China's animation industry during the "Twelfth Five-Year" period. It	2014 "Dragon Nest: Warriors' Dawn" - The first Chinese 3D animation to be screened globally. 2019 "Nezha: Birth of the Demon Child" - it became the highest-grossing animated film in China to date.

	proposed increased support for the creation of animated films and promoted the concentrated marketing of domestic animated movies.	2023 "Deep Sea" - The first innovative combination of "ink and wash" (the soul of traditional Chinese culture) and "three-dimensional" (the mainstream animation technology worldwide).

Table 1: The Evolution of Chinese Animation: Policies, Technological Advancements, and Representative animation from 1926 to Present.

As can be seen in Table 1, ink-wash painting animation is a branch of Chinese animation, and its development is closely tied to the overall evolution of Chinese animation. Rooted deeply in Chinese culture and history, the ink-wash painting animation style represents a significant aspect of the progression of Chinese animation.

For instance, from 1926-1956, when animation was just beginning to emerge in China, Chinese animation was still in its learning phase, gradually developing feature-length animations and color animations. Animations from this era bore some influence from foreign animations. For example, the character of Sun Wukong in 1941"Princess Iron Fan" bore similarities to Mickey Mouse from American animations, and 1955"Why is the Crow Black?" shared stylistic similarities with Soviet animations [17][21]. Furthermore, due to the instability brought about by war, the style of Chinese animation was not yet fully formed.

From 1956 to 1966, due to policy support, the Shanghai Animation Film Studio was established, marking the initiation of the Chinese School of Animation. This period was characterized by a diverse range of animation styles, leading to the birth of ink-wash painting animation. The first ink-wash painting animation piece, 1960 "Little Tadpoles Looking for Mama" is still recognized as a classic artwork today[22].

The "Cultural Revolution" that occurred from May 1966 to October 1976 virtually put a halt to all forms of creative work.

1976-1995 New Era. It's worth noting that during this period, with the proliferation of television, it became an essential medium for animation, subsequently transforming the format of animation. In 1979, "Nezha Conquers the Dragon King" became the Chinese first widescreen animation. With the advent of the four factors of globalization, including economics, China was also influenced, and commercial television animation gradually became mainstream[16][17][18][20][21]. This shift resulted in China abolishing the planned policy of unified purchase and distribution for animations between 1995-2004, propelling Chinese animation fully into the market. Moreover, "Feelings of Mountains and Waters" in 1988 became the last ink-wash painting animation of that era, while "Lotus Lantern" in 1999 signified the end of the ”The Chinese School Of Animation“ era [22][23].

From 2004 to 2012, with the support of new policies, Chinese animation began a new phase of learning and adaptation. This can be observed in animated film such as 2011 "Kuiba" and 2012 "Boonie Bears" , which bear strong marks of global influence [24]. In comparison to the period from 1926-1956, this era of Chinese animation can be viewed as a learning stage under the influence of new technology and a new age.

From 2012 to the present, while Chinese animation has been learning and implementing 3D animation technologies, it has also been ardently innovating and developing new techniques. The application of particle ink painting in the animated film "Deep Sea" (2023) can be seen as a new exploration and attempt at integrating traditional art forms with new technologies.

Chinese animated films have been continuously seeking and creating their unique cultural characteristics. Most of them incorporate Chinese cultural elements into their stories, character images, and visual elements. However, animation technology, primarily guided by cultural imperialism, has not made significant breakthroughs.

Hu Xiao posits that contemporary ink-wash animation has evolved in both form and technique, moving beyond a singular focus on traditional artistic conception. By considering aspects such as perspective, visuals, style, and rhythm in a holistic manner, creators are able to develop works that better adapt to the changing times and progress alongside them. Technologically, ink-wash animation has transitioned from cel-animation to 2D and 3D, with the recent emergence of VR technology offering new possibilities. However, the author critiques the loss of spontaneity and randomness in computer-generated ink-wash animations, as creators' preoccupation with intensifying story conflicts through camera switches can overshadow the unique aesthetic ideals of Chinese painting, which emphasize artistic conception and impact the imagination of time and space within the visuals [4].

Zhang in 2019 also points out that in terms of artistic conception, the author identifies three levels: the fusion of scenes, the interplay of reality and illusion, and the use of blank space. They argue that, compared to its early days, the content and expression of ink-wash animation during its revival period have undergone significant changes. No longer confined to mere aesthetics and ethereal qualities, ink-wash animation now integrates its artistic conception more deeply into real life. This expansion allows traditional mythological figures, vibrant fairy-tale worlds, and stories reflecting modern life to become subjects that ink-wash animation can express, resulting in more diverse content and richer expressions [25].

3 Methodology

In this qualitative study, we employ a case study to explore the application of "particle ink painting" technology in The Deep Sea (2023) and its impact on cultural identity.

This study will engage in a comprehensive examination of the film, involving detailed film analysis and thorough review of relevant scholarly literature. Discuss the implications of using "particle ink painting" technology in The Deep Sea (2023). Explore how this technology enhances the animation's cultural identity and promotes traditional Chinese art forms in a contemporary context, and consider how the implementation of "particle ink painting" technology in The Deep Sea (2023) might influence future projects or contribute to the evolution of animation techniques.

4 Findings

Deep Sea narrates the tale of a despondent girl named Xingxiu, who, feeling neglected and uncared for by her family, attempts suicide by leaping into the ocean. Fortuitously, she is rescued by a clown named Nanhe, who dreams of opening his own restaurant. The animated film primarily centres on Xingxiu's fantastical experiences while unconscious in the depths of the sea.

The "particle ink painting" technique enhances the animated film's cultural identity and promotes traditional Chinese art forms in a modern context. The technique combines the essence of traditional ink painting with cutting-edge 3D animation technology, bringing together the rich cultural heritage of Chinese art with the contemporary advancements in animation. By incorporating ink painting principles and aesthetics, the "particle ink painting" technique offers a distinctive visual experience. The fluidity, color gradients, and intricate details are reminiscent of traditional Chinese ink paintings, while the 3D animation and particle effects bring depth, movement, and a sense of immersion to the visuals. This fusion of traditional and modern elements can help to promote and preserve Chinese cultural identity in the rapidly evolving world of animation.

Visual effects director Guo Peng shared his insights on the particle ink-wash technique used in the film. The particle ink-wash style was determined after numerous trials and errors, representing an innovative fusion of "ink-wash" (the soul of Chinese traditional culture) and "3D" (mainstream animation technology worldwide) in feature-length animation. To realize ink-wash effects in 3D, The team conducted numerous experiments. They discovered that using 3D particle technology was the best way to convey the fluid and abstract beauty of ink-wash. Countless particles were employed to recreate the flowing sensation of ink-wash effects, which led to the term "particle ink-wash." Guo Peng explained that the significance of particle ink-wash lies in utilizing light, shadows, and color tones in the visuals to convey the emotions of the characters and the overall atmosphere of a particular scene. By emphasizing contrast, depth, and the realism of the camera, the technique draws the audience's attention to specific points within the frame. This immersive approach allows viewers to become fully engaged in the story [26].

The production team of "Deep Sea" has mentioned on multiple occasions the time-consuming, labor-intensive, and costly process of developing the "particle ink painting" technique. This involved attaching highly artistic hand-drawn textures to the surface of models to achieve a colorful rendering effect and further projecting the colored ink texture onto particle models to obtain the color-dragging effect generated by the particles' blurred motion within the system. While this approach created a fluid and colorful visual landscape, there were still some shortcomings that needed to be addressed. (see Fig.).

Fig. 1. Deep Sea Animated Film Poster

Firstly, the fundamental reason why it is difficult to develop a simulation model for ink painting in a particle system is the difference in the medium's response. "The diffusion and infiltration of ink in ink painting primarily occur within the paper. The water flow doesn't solely rely on gravity, but rather on the paper fibers' absorption and the adhesion of ink particles, which in turn create a diffusion texture." In "Deep Sea," the overall modeling is set in an underwater world, where seawater and various marine creatures serve as the medium for the ink color. Consequently, the monolithic approach to layering fails to reconcile the contradiction between the diversity of species and the uniqueness of their appearances.

Secondly, the focus of 3D animation construction lies in the realism of the Z-axis depth direction. The depth of the deep sea cannot be inferred solely through a kaleidoscope of colors; it requires motion perception in the visual space and a more distinct presentation of heterogeneous layers. However, excessive flat rendering with similar dazzling colors hinders the portrayal of depth in the deep-sea environment (see Fig. 2).

Fig. 2. Screenshots from Deep Sea

The particle ink technique often blends concrete and abstract elements. On one hand, it can depict tangible objects such as water and marine life. On the other hand, the free flow of particles can reveal an abstract sense of beauty, creating unique visual effects. It is used to represent intangible elements like water, clouds, and air.

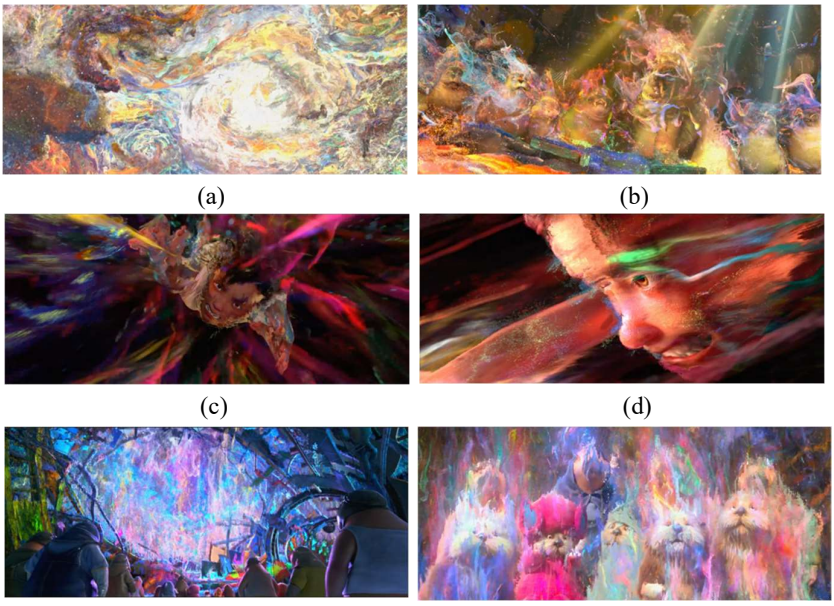

Fig. 3. (a, b, c, d, e, f) Sequence of scenes from Deep Sea showing Fantasy to Reality

Particle ink painting effectively expresses the interplay between reality and fantasy. For instance, in Figure 3, which illustrates the protagonist's descent into the wormhole, many of the imagined scenarios depicted in the film, such as the cruise ship and seafood restaurant staff, gradually fade away. Particle ink painting, by adjusting the brightness and color of the particles, presents rich lighting effects, symbolizing fantastical illusions in this context.

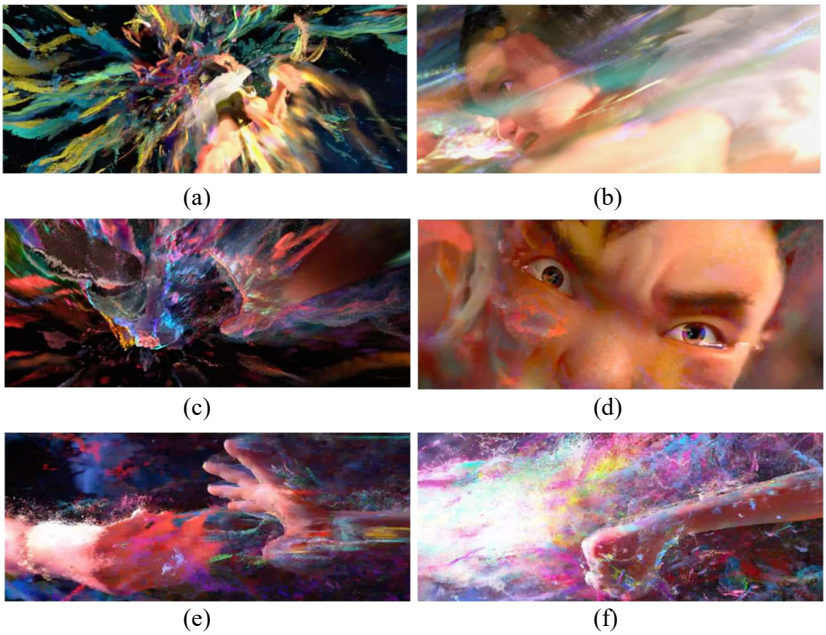

Fig. 4. (a, b, c, d, e, f) Sequence of scenes from Deep Sea conveys a sense of tension through the fluidity of traversing the wormhole

Particle ink painting also leverages the fluidity of particles to depict scenes combining motion and stillness. In Figure 4, the protagonist attempts to reach out for Nanhe's hand through the wormhole but fails to grasp it. Here, the particle ink painting technique visually portrays the velocity and fluidity of the surrounding environment. However, as an aesthetic device, the color presented by the particle ink painting doesn't establish a direct cause-and-effect relationship between the film's narrative and the characters' actions. The particle ink painting technique exists as part of the scenery, abstractly representing elements such as the sea, clouds, light, and dreams, without being fully integrated into the plot.

When the technique fails to establish a tangible connection between the characters and their actions and primarily serves to embellish and beautify the environment, it

contradicts Guo Peng's principle that technology should serve the story. If the technique and story were seamlessly integrated, the audience's attention would be focused on the changes in the characters' destinies created by the particle technology, rather than on the visual spectacle itself.

While the particle ink painting technique presents an innovative visual style, its shortcomings remind us that the incorporation of technology into animation should not only serve as a visual spectacle but also align seamlessly with the story and characters. In future developments, the "particle ink painting" technique could be further refined to create a more holistic and engaging animated experience.

5 Conclusion

In conclusion, the animated film 'Deep Sea' has significantly advanced the field of animation technology through its pioneering use of the 'particle ink painting' technique. This innovative method, which creates a unique aesthetic of color, primarily functions to express abstract objects and beautify the environment. Despite its developmental challenges and certain limitations, such as not having a direct link with the film's narrative or traditional Chinese arts and culture, it still enhances the film's cultural identity by blending traditional Chinese ink painting with modern 3D animation technology.

Despite the fact that the film's production techniques diverge somewhat from the essence of Chinese ink painting, which emphasizes the art of leaving blank spaces and expressing ideas implicitly, the production team's attempts to mimic the fluidity and particle-like texture of ink painting, alongside the film's own realism and concreteness, offer a visually stunning and immersive experience for the audience. As a compelling example, 'Deep Sea' (2023) demonstrates the potential of integrating traditional art forms with modern animation techniques to significantly contribute to the ongoing development of the Chinese animation industry and beyond. By ensuring that technology serves the narrative and integrates seamlessly into the story, 'Deep Sea' promotes traditional Chinese art forms in a contemporary context, setting a precedent for future animations, both in China and globally.

Future studies could probe further into the intricate technical dimensions of the "particle ink painting" technique. Aspects such as the software tools employed, the difficulties encountered during its evolution, and prospective enhancements or alternate methods that could be investigated for future endeavors might be considered. This exploration would furnish crucial perspectives for animation professionals and scholars who harbor interest in leveraging analogous techniques.

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