



Digital Design and Research of Ink Art Based on Infrared Interactive Projection Technology - Taking the Work of “Listen to the Ink” as an Example

Yarong Deng^(✉), Lihong Luo, and Xiaoying Tang

Guangdong University of Technology,
No. 729 Dongfeng Road, Yuexiu District, Guangzhou, Guangdong, China
dyr806800257@qq.com

Abstract. In the interactive desktop projection “Listening to Ink”, through the appreciation of the existing digital ink art, we try to use the infrared interactive projection technology to combine the ink art and the interactive device, to achieve a new interactive way, breaking through the traditional inertial cognition in ink art.

The infrared interactive desktop projection system of “Listen to the Ink” works includes a projection module, an infrared transmitting module and a sensing module. Firstly, an infrared interactive desktop projection system consisting of three modules was built; the infrared light reflected by the finger touch or the laser pen was illuminated by the camera; then the information was transmitted to the image processing module, and multi-point positioning and analysis were performed; After judging the operation intention, the processing result was transmitted to the corresponding application in a standard form, and corresponding operations were performed. Finally, a digital ink art based on interactive projection was completely realized, which provided new ideas for exploring ink digital art.

Keywords: Ink digital art · Infrared interaction · Desktop projection

1 Introduction

Chinese ink painting is a natural and poetic cultural carrier. It is one of Chinese national quintessence culture and plays an important role in Chinese art history.

In the era of multicultural development and collision, in the process of wide application of various media materials, digital technology has also participated in ink art with its unique charm. When ink painting entered the creation of contemporary digital art, works began to combine new media technologies with ink symbols. From simple ink digital animation, photography, digital painting to ink art behavior, ink art installations and other multi-dimensional virtual space art forms. In the experimental art combining new media technology and ink symbols, try to break through the boundaries of ink art [2].

At present, there are two main ways to express ink art using digital technology: One is based on planes. From the perspective of the drawings, there is an ink expression that depicts the digital image purely using ink media; and there also have an ink art performance that refers to composite materials and digital technology. For example, Huang Yihan's "New Generation" and "Cartoon Generation" series; Mao Donghua's "Cloudy to Sunny"; Dan Zheng's "One Day of Alice" and so on. The second is the creation of behaviors, images, and installations. Liu Xuguang's "Sound"; Image "Ink Drop"; Wang Chuan's installation "Zero"; Wang Tianyi's installation "Ink Table", "Digital Series • Lonely Mountain", etc.; Barbara Edelstein's image "Tree of The Life" series and the Leaf Book series and more [3].

The ink art work "Listening to Ink" was realized by infrared interactive desktop projection interactive method, and the interactive content was divided into three scenes: The first act of "Listen to the Ink" was to bring the audience into the ink scene. The audience began with the brush to draw the ink point, followed by the ink waterfall, the fishing boat and the lotus flower, then bring the audience into the ink world. The second act was the String Song Interaction. The interactor used the brush to play the ink string, and the string changed with the sound into a splash, a crane, a dragon, etc., to achieve audio-visual interaction. The third act was the interaction between the fish and the disks. The patterns are respectively put into three white disks by interactive projection. The color changed the pattern with difference music, the interactor held the brush to touch the plate to appear ink dots. Then the ink dots changed into a swimming fish, complete the interaction. This form of interaction breaks the one-way spread of traditional ink, giving viewers a more impactful form of expression, and further innovation in culture through creative attempts combining modern technology with traditional art.

2 Creative Innovation of Ink Art

2.1 New Way of Viewing

"Ideology" is an important part of Chinese classical aesthetics, and it is also the aesthetic standard of a unique Chinese art painting of traditional Chinese ink painting. Many Chinese painters regard "Ideology" as the creative principle of Chinese ink painting, and use "Ideology" as the appreciation principle of works. Environment and imagination are the source of artistic conception [4].

The traditional Chinese ink paintings are mainly created on the table, and they are created on the flat paper or enamel. The table and the creator are in a vertical angle. The creator's charm is vivid, and the bone method is integrated into the flat paper.

In the traditional form of viewing, Chinese ink painting is mostly displayed in vertical static art, and it also determines the audience's single and passive viewing angle.

The first act of "Listening to Ink" is to introduce the ink rhyme. The audience starts with the ink brush to draw the ink point. The desktop projection method realizes the change of the ink culture viewing angle, transforming the audience from a quiet parallel angle to ink painting. The vertical angle of the countertop is appreciated, and the innovation of dynamic display form and interactive viewing mode is realized.

The creation of “Listening to Ink” is a work with unique artistic conception, which integrates the environment and creative content into a whole, making the work extremely vital and inspiring the audience’s imagination. These abilities are called work’s vitality (Figs. 1 and 2).



Fig. 1. Traditional ink painting form.

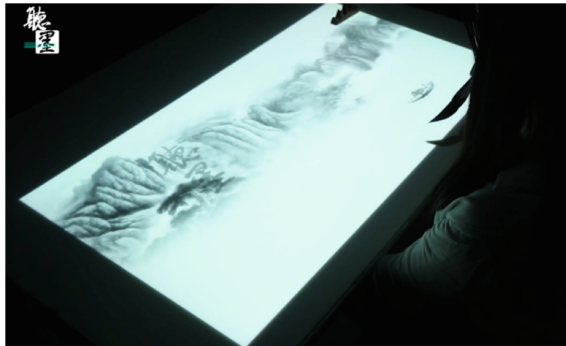


Fig. 2. 《Listen to the ink》 form.

2.2 New Way of Viewing

In the second act of the ink art “Listen to the Ink”, the audience used the brush to move the ink strings, the strings changed with the sounds, and the creators tried to blend the Chinese ancient string music with the Chinese ink elements. Using digital media technology to change the viewer’s inertia cognition when watching ink painting, emphasizing the connection between hearing and ink painting art, and realizing the synchronous experience of visual and auditory ink painting.

The view of the form and spirit of Chinese ink painting is a contradictory concept. It is the most frequently used concept in Chinese ink painting to express aesthetic thoughts and is also part of Chinese traditional aesthetics. Gu Kaizhi’s “Theory of

Painting” laid the view of the unification of Chinese ink painting. “Shape” is a depiction of the external shape of a thing, and “Spirit” is a depiction of the inner ideological activity or characteristics of a thing [5]. In the second act of “Listening to Ink”, the audience was quickly substituted into the artistic conception of ink in a dim environment, and the pen in the hands was forgotten, the external identity was forgotten, and the spirit was concentrated in the creation of ink art. Every audience is a painter, and every painter can create a perfect work of art. At the same time, with the ancient string music as the background, the perfect combination of visual sense and touch sense (Fig. 3).

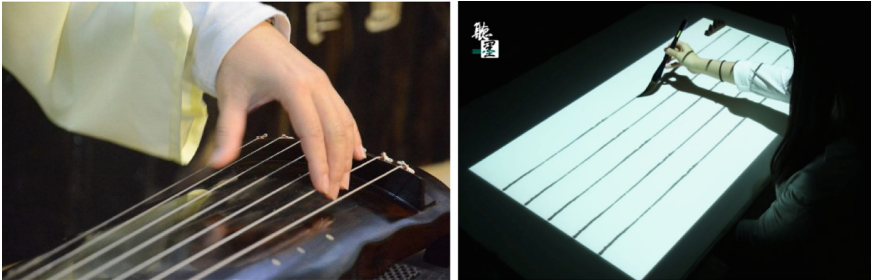


Fig. 3. The second act of “Listen to the Ink”—New sensory experience.

2.3 New Way of Interacting

One of the artistic essences of Chinese ink painting is “vigorous and vivid” [6]. The charm of the work is distributed throughout the creative environment. The traditional Chinese ink art is mostly a one-way subjective taste and artistic conception of the creator. With the rapid development of digital technology, the digital application of ink art attempts to spread from one-way culture to two-way interaction.

In the third act of “Listening to Ink”, the patterns are placed in three white discs in a projection manner, and the color of the pattern changes with the music. The audience held the brush and the fish jumped between the plates as the audience touched. The creators have enriched the sensory experience of ink culture with the combination of audio and sound. The desktop projection ink creation table has broken through the single and boring display method of ink. Using new media technology to realize the interaction between the real ink creation tool (brush) and the virtual pen and ink creation table (desktop projection), creating a complete ink and wash creation immersion space. It perfectly presents the “vibrant and vivid” of Chinese ink painting (Fig. 4).

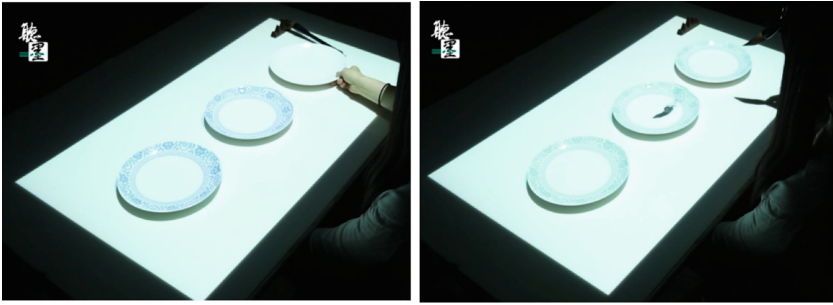


Fig. 4. The digital creativity of “Listen to the Ink”

3 The Digital Technology of Ink Art

The interactive projection system is a combination of dynamic capture technology and virtual reality technology. It is a technology that generates three-dimensional or two-dimensional images from a computer and provides users with a virtual space image and interacts with it. By mixing reality, the user can also touch the real environment while manipulating the virtual image, thereby enhancing the sensory experience. Allows the experienter to better participate and immerse in the projected image for a more intense and realistic interactive experience. The operation principle of the interactive projection system is firstly to capture and capture the target image (such as the participant) through the capture device (sensor), and then analyze by the image analysis system to generate the motion of the captured object, the motion data combined with the real-time image interaction system. To create a close interaction between the participants and the screen [7].

In 2009, at the American International Consumer Electronics Show in Las Vegas, USA, a light-touch interactive projector won the applause of visitors and experts. It can turn all the common plane into a touch screen, and realize the interaction of the screen by dancing the limbs. This marks the official application of interactive projection technology and has caused great repercussions in the market.

Desktop projection is a product derived from the application of interactive projection technology. As a new high-tech product, desktop projections have been paid attention to in the mainland, and many investors have poured in, which has accelerated the development of the desktop projection industry, and related application fields have been continuously developed. Desktop projection games are currently mainly used in entertainment venues such as KTV, bars, nightclubs, etc., which enhances the entertainment experience of consumers to a certain extent, and can also drive additional operating income of the business premises (Fig. 5).



Fig. 5. Desktop interactive projection

3.1 Ink Effect Rendering Technology for 3D Models

The movement of the three-dimensional models in the “Listen to the Ink” works is achieved through the bound bones in C4d. The ink effect of the model is based on the material ball of the C4d software. In addition to adjusting the color and transparency properties of the Shader, the texture is added to the color and transparency channels to achieve the subtle ink effect of the 3D model. After attaching the 3D model to the ink effect material, you need to add the TFD plug-in application to complete the random generation of the ink (Fig. 6).

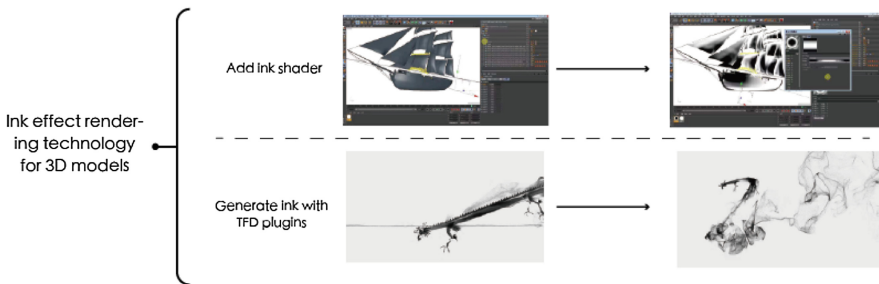


Fig. 6. The digital creativity of “Listen to the Ink”

3.2 Infrared Interactive Desktop Projection Technology

In the aspect of interactive equipment construction of “Listen to the Ink”, after comparing and analyzing various technologies for realizing desktop interactive projection, the infrared interactive desktop projection technology was adopted to realize the digital innovation of ink art.

The light projected by the projector is visible light, and its infrared part is filtered by the filter film inside it [8]. Therefore, it can't see the projector's projected content for the camera. If the infrared light is strong, the camera can see the human body. How to enhance the image of the object seen by the camera? Fortunately, the infrared active emission technology in the market is very mature. For example, the night vision camera sold on the surveillance market can emit near-infrared (850 nm), which is more powerful. There is a special long-range infrared light, and the camera can reach 5 m without overnight, so it is not needed.

The night vision camera actively emits infrared, and then the ccd sensor accepts infrared. Then the most difficult part of the interactive projection, the segmentation of the human body and the background virtual object is solved, and the camera obtains a black and white monochrome background including the image of the person. Next, to detect the movement of the human body, the image difference technique is adopted. The difference is to subtract the images of two consecutive frames obtained by the camera, then what is obtained, and the obtained part is the movement, so if the person is moving the difference will intercept the moving part.

The next step is to analyze the data obtained, and then project the virtual part. Of course, complex interactive projection is not just these technologies. These are just the most basic principles. In the meantime, it involves the calibration of the camera, the optical flow method to find the direction of motion, the optimization of performance, and the special effects

The complete hardware device of the infrared interactive desktop projection system includes a projection module, an infrared transmitting module and a sensing module. A new projection system based on multi-touch, gesture recognition and other technologies, captures the infrared light reflected by the finger touch or the laser pen when the projection screen is illuminated by the camera, transmits the information to the image processing module, and performs multi-point positioning and analysis thereon [1]. After judging the operation intention, the processing result is transmitted to the corresponding application in a standard form, and corresponding operations are performed to realize the digital creation of the “Listen to the Ink” work (Fig. 7).

The target image (such as the participant) is captured by the capture device (sensor) and then analyzed by the image analysis system to generate an action of the captured object. The motion data is combined with the real-time image interaction system to enable the participant and the screen. Produce a tightly integrated interaction [9].

To detect the movement of the human body, the image difference technique is adopted. The difference is to subtract the images of two consecutive frames obtained by the camera to obtain the moving part, so that as long as the person is moving, the difference will intercept the moving part. The next step is to analyze the data obtained, and then project the virtual part. Then simulate the mouse message to the window in the foreground.

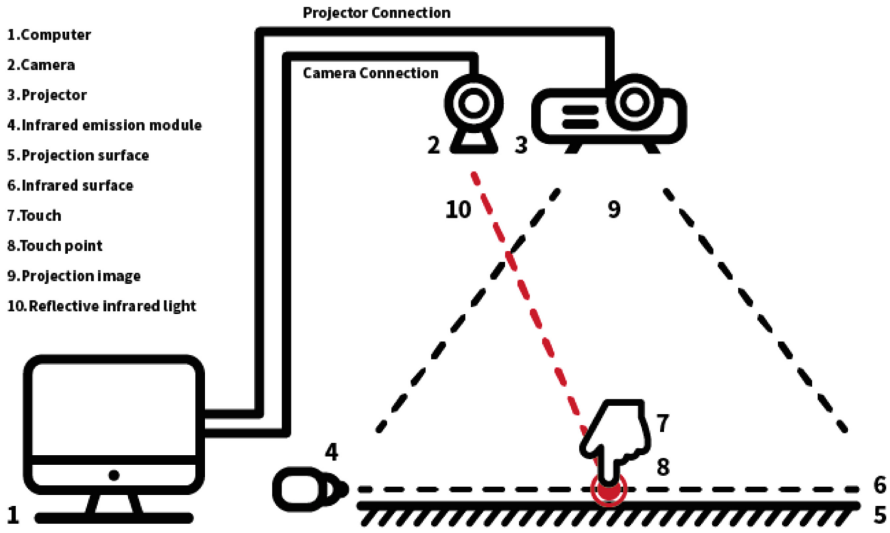


Fig. 7. Infrared interactive desktop projection system

4 The Innovative Significance of Ink Art

4.1 Creative Meaning

As one of the representatives of China’s national quintessence, ink art plays an important role in Chinese art history. The traditional ink art combines the human spirit and the natural realism with a touch of ink, which arouses the viewer’s resonance. However, the limitations of traditional ink painting have created a sense of distance on the path of communication, which conflicts with the characteristics of today’s “interactive” and “autonomy”. Under the current aesthetic cognition that emphasizes the combination of multiple sensory experiences, the ink painting presented in the form of plane vision needs to be passed through [10].

There are still many ink paintings in the museum or private collections for a hundred years, which have failed to let the world appreciate their beauty. Therefore, the digital media art has given the deep meaning of innovation to the display of traditional ink paintings. Yang Chun, who graduated from the Central Academy of Fine Arts, came to the Oscar Film Awards in the United States for his work on the theme of the Song Dynasty fan painting “Red Dragonfly Waterfowl”. The national painting style impressed the judges and was nominated for an Oscar [11].

As early as during the Shanghai World Expo, a classic Chinese ink painting “The Riverside Scene at Qingming Festival”, which was moved by the exhibition, was a sensation. So far, the “Qingming Shanghe Map” made by digital media technology is still on display in the Forbidden City. It is hard to find a ticket every day.

With the continuous development of cross-media technology integration, the trend of integration and mutual penetration of art and technology is increasing, and the new media art has brought about the change of aesthetic style, that is, the viewers are more

eager to participate in the physical state. The creation of “Listening to Ink” works to let the traditional ink art show to the audience in the form of static to dynamic, visual and auditory and more sensory.

In the context of new media art, we combine modern technology with traditional art to create new forms of expression. In this way, we use the audio-visual interaction method to re-create and re-expose the ink-and-wash works, break through the inertia cognition of the ink-and-wash art with visual as the main body, emphasize the connection between the auditory and the ink art, and finally achieve the win-win of artistic expression and bring the viewers a win-win situation. It not only has cultural heritage but also brings visual impact to the artistic expression, and realizes a new analysis and experience of ink and wash, and expands the new field of traditional cultural heritage (Fig. 8).

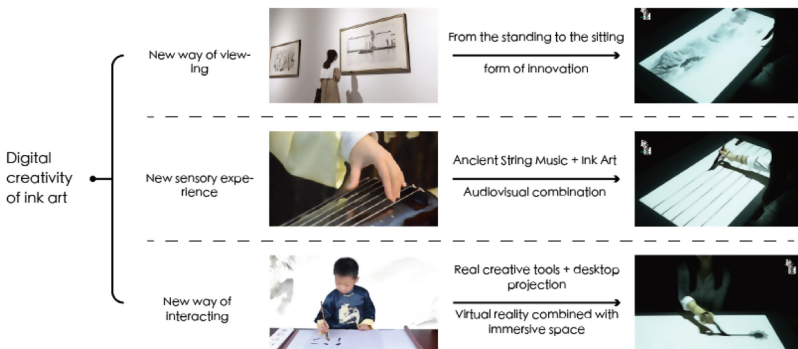


Fig. 8. The creative meaning of “Listen to the Ink”

4.2 Social Significance

The desktop projection ink interactive work “Listen to Ink” was selected in October 2018 to participate in the Beijing International Design Week “The 2nd Contemporary International Ink Design Exhibition” exhibition and won the gold medal. “Contemporary International Ink Design Exhibition” is an important component of Beijing International Design Week. It is the leading brand of “Ink Design” at home and abroad. The works exhibited include various forms of information such as information, concept, design, experiment and media. Among the more than 2,200 pieces of the works, only 3 gold medals were selected. The desktop projection interactive work “Listen to Ink” stood out in many works and won the gold medal. It is also the only gold award in the media design category. The exhibition and award-winning information were reported by many domestic media such as NetEase, Sohu, Phoenix.com and today’s headlines. At the same time, the exhibition works will be invited to tour in Mexico. The “new interpretation” and “new proposition” of ink design will go to the international stage.

5 Conclusion

The continued development of digital media art, continuous creation and re-creation, innovation and innovation, it is not only limited to the film and television we have seen, but has penetrated our lives. From traditional ink painting to ink animation to modern interactive new media, it can influence the art of ink painting to influence our ethics, aesthetics, politics, and our everyday feelings and perceptions. The culture of digital media art is an open culture, allowing people to review and think, and to provide feedback. The future of digital media art will not be limited to ink animation or other forms of animation. It is slowly expanding into the cross-disciplinary field, in the environment of graphics, space, sound, film and television, contemporary art, advertising culture, etc.

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