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A Rational Survey of Art and Technology

From Traditional Painting to Intelligent Painting

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***Abstract*—The development of science and technology affects not only the material life of mankind, but also the spiritual world of mankind. The development of science and technology has brought unprecedented changes to the current visual arts, and the intervention of digital technology has brought great changes to the creation and aesthetic taste of traditional painting art. Based on the characteristics of traditional painting, digital painting and artificial intelligent painting, this paper expounds the similarities and differences among the three, and explores whether the emergence of digital painting and artificial intelligent painting system will cause the death of traditional painting. Is it true that modern high-tech technology can perfectly replace everything and dominate the world? With the rapid development of science and technology, where will the art of painting go?**

Keywords—traditional painting; digital painting; artificial intelligence painting; feature; development

I. INTRODUCTION

In the context of today's digital age, technology offers more possibilities for all aspects of human life. Science and technology are not only changing the way we live, improving the quality of our lives, and influencing our culture, but also bringing potential crises to the future. As Yuval Herali put it in "A Brief History of the Future", "The development of science and technology represented by big data and artificial intelligence is becoming increasingly mature.……In the future, human beings will face three major problems: biology is an algorithm, and life is a process of continuously processing data; the separation of consciousness and intelligence; and the external environment with big data accumulation will know ourselves better than ourselves. How to look at these three issues and how to take countermeasures will directly affect the future development of mankind."[1]

The development of science and technology also plays an important role in the field of art. In the field of visual arts, the birth of photography more than 100 years ago has had a tremendous impact and change on visual arts. Later, with the maturity of digital technology, various kinds of digital visual art software appeared. Everyone was immersed in the novelty brought by multimedia art, digital painting and digital sculpture. Then the emergence of the digital central nervous system once again brought new changes to various industries. The ever-changing science and technology has brought unprecedented changes to the visual arts of today. Some people are horrified, some are delighted, some are resisting, some are accepting, but whatever the attitude of human beings, what should happen still happens. As Zhang Li, deputy director of the Hao Museum of Art, put it, "Artists can only work from the core and mechanism of technology if they want to make a difference... Exploring the safe exit of the human spirit from the reflection on technology, and endows the work with new thinking and aesthetics."

II. TRADITIONAL EASEL PAINTING

Traditional easel painting artists use the pen in their hands to complete their own works of art that belong to the artist himself in the space and time of his life. The pen is a tool in the hands of the artist. In the process of artistic creation, this tool is an extension of the human hand and an externalized and extended organ of the artist. Through the omni-directional coordination of tools, hands, eyes, heart and brain, artists complete the creation of artistic noumenon, which is the result of the omni-directional participation of human perception system: touch, sight, hearing and even taste. The touch of the body with pen and paper brings the most immediate sensory experience; The entire creative process is an all-round fit of heart, brain, hand, and eye, with a non-stop interaction from heart and brain to hands and eyes, and then from hands and eyes to heart and brain; Artists use various types of tools such as pens, knives, brushes, and even the body to draw, write, dial, trace, scratch, sprinkle, paint, wipe, press, wipe, scratch, carve, expand, print and so on to depict the image of the mind on paper, cloth, board, wall, etc. This creative process is the most perceptual tactile experience in which the body's tactile organs cooperate with the heart and brain ("Fig. 1"). The sound of the pen dragging across the paper and the blade across the canvas are the hearings involved in artistic creation; The fragrance of ink,

the smell of paint and the taste experience will also have a certain impact on the creation of art. The omni-dimensional participation of human perception system makes the traditional easel painting have the physical and mental attributes of human nature.

Fig. 1. Traditional oil painting "Wind", author: Liu Xinlu.

III. Computer Painting After the Intervention of Digital Technology

From the age of farming to the age of handicrafts to the age of industry, in the evolution and transformation of the times, every change and progress reflects the improvement of human capabilities. The intervention of digital technology has greatly changed the traditional artistic painting creation method and aesthetic taste. The development of modern production technology in the post-industrial era of the 20th century has also led to the rapid development of multimedia technology, which has brought about tremendous changes in all aspects of our lives. From the moment the first truly digital computer appeared in 1946 to the present few decades, the speed of computer development is amazing. The continuous updating and iteration of computer hardware and software systems have also allowed digital technology to quickly enter the field of artistic creation. Since the popularization of personal computers, the creation of art has derived a new branch of digital painting from the traditional easel painting. Computer painting was born from the time when computer software programs were used to create. This amazing technology transforms the basic form of information into a digital code that can be processed at will on its machine. Computer painting is based on numbers. Images are composed of pixels, and each pixel is encoded by a number of binary digits to form a virtual visual image. Computer art painting works are input and output with such digital codes. There are various kinds of digital painting software today. PHOTOSHOP, CORELDRAW, PAINTER, ZBRUSH, etc. are relatively common software for computer painting and image processing. The software can simulate all the strokes of traditional painting, as shown in "Fig. 2". This computer painting works, through the strength of the electronic painting pen pressure lever, self-made texture effect and color harmony, etc., make the picture achieve the texture effect of oil painting knife and pen shaping. There are any pens for computer painting, whether it is various oil brushes of western painting or various types of traditional Chinese painting brushes, or watercolor pens, water chalks, charcoal brushes, markers, etc., and the size of any pen can be adjusted at any time. Computer painting can also simulate a variety of paper materials and canvases, whether it is cooked or raw paper used in Chinese painting, gouache paper, watercolor paper, or a variety of oil canvas, even Korean paper , Light-sensitive paper, etc. At the same time, digital software can create brushes and canvases according to the artist's preferences. The richness of brushes and canvases is only unexpected, not impossible. In addition, highly configured digital equipment provides computer painting

with 99%s RGB and accurate restoration of fine colors. The number of colors on the display is up to more than one billion, which can bring more adequate color to the artist. This is difficult to achieve for traditional painting. The richness of brush strokes, paper effects, and color effects in computer painting far surpasses traditional painting, which is also the most prominent advantage of computer painting.

Fig. 2. Computer painting "The Onlooker", author: Liu Xinlu.

The creation space and process of computer painting are also greatly different from traditional painting. Traditional painting uses much more space than computer painting. Computer painting requires only a computer, a hand-painted board, a hand-painted pen to start operation and creation. At the same time, the completed digital works can be arbitrarily enlarged or reduced according to the requirements of the author, while the traditional painting authors need to paint in a space far larger than the size of the painting they want to create, therefore, the requirement of space for large works often becomes a difficulty in creation. There are also great differences between digital painting and traditional painting in the process of drawing. Digital painting is completely different from the linear creation method of traditional painting, which can be reversed and redone when any step goes wrong. In the process of digital painting, each step can be saved at any time, and can be withdrawn to any step in the process at any time, which is convenient for modification in any situation. At the same time, the modification is not only the modification at any time from any link, but also the partial parts under different links can be grafted at will. For example, the partial grafting of the third part and the seventh part can be made, and the effect of the two steps can be superimposed. This is a completely anti-linear way of creation, which breaks the conventional way of creation and brings more possibilities and unpredictable effects in artistic creation. However, once there is an error in traditional painting, it can only be repainted, especially for Chinese ink painting and watercolor painting, if they fail to express in one place, the whole painting will be scrapped. Works such as oil painting and gouache are slightly better. Partial mistakes are fine as long as they are repeated, but any traditional painting can not be withdrawn to any previous step. There are also some powerful functions in computer painting, such as filters, which is a program that can process various effects on works. Filters can produce many magical effects, such as adding light effect to the work, attaching materials, removing stains, dusting, adding special effects, etc. For example, ("Fig. 3") in the work of "The Holy Land", effects such as light effects, adhesion of metal materials, dust, and superposition are used. Computer painting can deform or distort any area in the work, can refract patterns, simulate light reflections, etc. It can also stylize the work, and can push, pull, rotate, reflect, fold and expand any area in the work. There is also the symmetry function in digital painting, which can be left-right symmetrical, up-down symmetrical, and multi-directional symmetrical, which is also not available in traditional painting. There is also a color channel, which can be used to make color adjustments for already drawn works. Similar functional processors add countless possibilities to digital painting. However, the paint in computer painting, as well as brushes, paper, canvas, and so

on are all virtual numbers. No matter what kind of brushes are used in the software when drawing, the drawing is done through the freehand pen associated with the software. Compared with traditional painting, it lacks the direct feeling of the instinctual sensory system of the human body, weakens the physical and mental attributes of human beings, and is inadequate in the expression of human emotions in paintings.

Fig. 3. Computer painting "The Holy Land", author: Liu Xinlu.

In addition to desktop digital painting based on computers, drawing software and freehand pens, there are also other digital painting methods. For example, German artist Pini uses the sky as a canvas, and uses digital laser beams as a paintbrush to create "Olympic Rainbow". American artist Ballard's "Visualization of Time" and "Remains" ("Fig. 4") take landscapes in nature as elements, capture a large number of high-resolution natural landscapes with high-precision laser scanners, and then output them to large-format collectible photographic paper after complicated mathematical rendering by computer. The high-precision geometric reconstruction and the defects generated during the 3D scanning process constitute a hybrid visual form between real and virtual. This new visual synthesis formed by the observation and analysis of natural landscapes through technical equipment gives new meaning to the natural environment. These are also mathematical paintings that are different from traditional paintings.

Fig. 4. Computer painting "Remains", author: Italian artist Quayola.

New technology will promote new media and new languages. Digital painting will not replace traditional painting, but will develop a painting language unique to digital painting. The rapid development of digital painting not only extends the ways of artistic creation, but also presents a new way of artistic appreciation. Digital art blurs the line between real and virtual reality. Digital art is a great

leap forward in the development of art. The concept, content and form of traditional paintings are no longer prominent. The value of virtual art is breaking the value system of traditional art. Works of art generate real value in virtual space in digital and radio transmission and exchange. The Internet becomes the largest art museum in the world. The virtual and physical value generated by displaying and disseminating works in this largest and even infinite virtual art museum is inestimable.

IV. INTELLIGENT PAINTING UNDER ARTIFICIAL NEURAL NETWORK TECHNOLOGY

As an extension of human organs, the advantages of digital painting tools and the new painting language it forms cannot be underestimated. It may even be that machines are becoming the new organ of the human race, and that the new organ of the human race is beginning to manipulate the human race in reverse while bringing new experiences and a better life. Perhaps as Yuval Heralli put it in "A Brief History of the Future", "With the rise of machine learning and artificial neural networks, more and more algorithms will evolve independently, improve themselves, and learn from their mistakes. The amount of data analyzed by these algorithms is astronomical, which is by no means within reach of human beings, and they can also find patterns that humans cannot find and use strategies that humans cannot imagine. The earliest seed algorithm may be developed by humans, but as the algorithm gradually develops, it will go its own way to a place where humans have not set foot and are unable to pursue." [2]

"David Hubel and Torsten Wiesel, Harvard neurobiologists, have conducted in-depth research on information processing models of nerve cells in the retina and visual cortex... MIT's Marr builds a mathematical model for visual information processing. In 1974, Harvard's Wopos's dissertation proved that in neural networks ... the learning method of 'back-propagation'... In 1982, Hopfield, who was a professor of biophysics at the California Institute of Technology at that time, proposed a new neural network that can solve a large class of pattern recognition problems and can also give approximate solutions for class combination optimization problems. This neural network model was later called the Hopfield Network." [3]…The research of scientists in the field of artificial intelligence has contributed to the rapid development of this field. Based on Adaboost algorithm [1] and convolutional neural network [2] artificial neural network technology, scientists call this technology "Inceptionism". The technology is expressed in layman's terms as a machine with a human brain and the ability to learn, judge and even create. At present, artificial neural networks are still in its infancy, and most of the software and hardware are still in an unstable development period. It can also be called the early childhood period of artificial neural networks, and the humans at this time can be called the mothers of artificial neural networks. Humans are like treating young children, and tens of millions of training samples are continuously input into the network on the neural network that is still being improved by humans, just as mothers teach young children. In this process, humans continuously adjust network parameters until the artificial neural network can recognize and master them, and at the same time give humans the desired results according to the instructions issued by humans. At present, many institutions around the world are exploring and practicing artificial neural networks in various fields. For example, Microsoft Xiaobing, born of artificial intelligence, is an artificial intelligence system with EQ created by the intergenerational upgrade through the intervention of artificial intelligence network based on the comprehensive application of cloud computing and big data. This system has an intelligent interaction of vision, language and emotion. Based on this artificial intelligence technology, "I Know I New", "Breeze" and "I Miss You" created by artificial intelligence singers swept the Internet. 2017 also saw the emergence of a collection of poetry by artificial intelligence, "Sunlight Lost Glass Window"... The development of artificial intelligence is amazing.

Artificial neural networks are also involved in the field of painting. At present, in the field of painting, artificial neural networks can achieve the qualitative perception of the image level provided by humans, understand the input neural network images, form memories, and conduct self-thinking and creation independent of human brain. This painting mode that is out of the human thought is called artificial intelligence painting.

Machines under the "Inceptionism" no longer need people's thinking and assistance. When the intelligent painting under the digital central nervous system completely gets rid of the human thought and will, and can make artistic creation autonomously, the machine has completely changed from a physical performance into a biological intelligent system. However, today's bio-intelligent painting system is still in a low-level infant stage, and it cannot be completely separated from human guidance. For example, Gu Juyi's artificial intelligence painting "I and the Hong Kong-Zhuhai-Macao Bridge", Gu Juyi inputs his print avatar works, Hong Kong-Zhuhai-Macau Bridge and some background elements, as well as famous painting styles into artificial intelligence painting software, and then the artificial intelligence painting software disassembles, combines, and rebuilds the elements, and completes the artificial intelligence painting "I and the Hong Kong-Zhuhai-Macao Bridge" through the unique algorithm of artificial intelligence ("Fig. 5"). This starting artificial intelligence painting software is like a knowledge base system, in which certain elements are added to the set software, and simple integrated painting works are dismantled and combined by the software. Although this

[1] Adaboost algorithm: Adaboost algorithm is an iterative algorithm. Its core idea is to train different classifiers (weak classifiers) for the same training set, and then combine these weak classifiers to form a stronger final classifier (strong classifier).

[2] Convolutional Neural Network (CNN): Convolutional neural network is a kind of feedforward neural network, which is usually used to process multidimensional array data. Many data forms are such multi-dimensional arrays: 1D is used to represent signals and sequences including language; 2D is used to represent images or sounds, and 3D is used to represent video or images with sound. Convolutional neural networks use four key ideas to take advantage of the properties of natural signals: local connection weight sharing, pooling, and the use of multiple network layers.

type of artificial intelligence painting is only a synthetic work that inputs elements and then presses the start and stop keys, it is a qualitative leap forward as the start of artificial intelligence painting.

Fig. 5. Artificial intelligence painting "I and the Hong Kong-Zhuhai-Macao Bridge", author: Gu Juyi.

The recent sale of an artificial intelligence painting at Christie's in New York for $192,500 shocked many artists. When science and bioengineering intervene in the arts, the complex network of connections in human brains that distinguish man from other living creatures is replicated or even surpassed, an unpredictable era will begin. Moreover, this biological system can work tirelessly and continuously, and the rhythm of life contained in art works, such as rest, has been dissolved to reflect its humanistic value and significance as the creation of art works.

V. CONCLUSION

With the advent of digital painting and the digital central nervous system, will traditional painting die out? Is it true that modern high-tech technology can perfectly replace everything and dominate the world? All walks of life are arguing, and so is painting. Science and technology lovers believe that high-tech can not only simulate various types of pens, knives, and brushes, but also that various strokes generated by high-tech are beyond the reach of traditional painting, and the dimension and fineness of color are beyond the reach of traditional painting. Now that there are better new tools, old tools that are lagging behind certainly should be thrown away. Science and technology lovers believe that traditional painting is incompatible with the contemporary era of multimedia vision, and new paintings under high technology will necessarily replace traditional painting. Traditionalists believe that tradition is the foundation of human existence and should not be discarded, but kept intact and refined. In my opinion, existence has its value, and there is no need to artificially create an antagonistic relationship between the two. Traditional easel painting, computer painting, and intelligent painting under the digital central nervous system both have their relative independence. There are similarities and differences between them. Under their common characteristics of visual painting art, they have many totally different differences. What we need today is to examine and face from the perspective of the whole social development and from the macro standpoint of culturology. The creation process of traditional painting has human perception system: the full participation of touch, sight, hearing, and even taste, which has the physical and mental attributes of human. This kind of hands-on creation will be the best spiritual compensation for the cold technological creation with distance. However, digital painting and artificial intelligence painting under science and technology are also developing into a new artistic paradigm. Will the

future follow Fromm's prediction that humans will become soulless machines and machines will become soulful people? Maybe everything is uncertain, but the development of science and technology has indeed changed people.

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