

The Relationship between Art and Science and the Infiltration of Science in Traditional Chinese Painting

Kaiyuan Chen¹, Peng Zhong², Shengling Zhao^{*3}

Kaiyuan Chen¹:1749881365@qq.com, Peng Zhong²: 931879695@qq.com,
Shengling Zhao ^{*3}:1796167263@qq.com *

Qilu University of Technology (Shandong Academy of Sciences), Jinan 250353, China

Abstract. Art and science are two very creative disciplines, and belong to different types of disciplines, which have their own unique and different from each other. Art and science are both important components of human creation activities, and they jointly contribute to the chapter of human civilization. From Pythagoras School in ancient Greece to Renaissance painting to Escher's iconography to the vigorous development of contemporary society, it can be seen that the integration of art and science has been from ancient times to the present. The rapid development of science and technology since the second half of the 20th century has opened up a new direction for the innovation of Chinese painting in the field of fine arts due to the development of modern science and technology, injected new ideas and new ideas into the innovation of Chinese painting, and also added a material basis for the innovation of Chinese painting. In turn, the innovation of Chinese painting has formed a beautiful landscape in the development of modern society.

Keywords: Art; Science; Mutual influence; Traditional painting

1 Introduction

Based on the data correlation of the keywords "art and science" in the "Science Citation Index", "Engineering Index", "Chinese Social Science Citation Index", and "Overview of Chinese Core Journals" from 2017 to 2023, using Citespace software for analysis, it can be concluded that the term "art and science" mainly revolves around art, science, discipline construction, art science, and film philosophy. However, there are few articles specifically exploring the relationship between art and science, as well as articles on the infiltration of scientific concepts in Chinese painting, which provides the rationality and feasibility of this study and expands the field of Chinese painting research.

2 Chapter One: The connection between art and science

Italian esthetician Croce said, "Art and science are different and interrelated; The two meet aesthetically." Qian Xuesen put forward the modern science and technology system, which includes the theory of literature and art. Qian Xuesen believes that the theory of literature and art is the law of studying artistic creation, and the Angle of studying the objective world from which human subjective practice and objective reality interact to achieve the same aesthetic

feeling. These laws are systematic, they can be carried out scientific research, and it is concluded that the theory of literature and art belongs to the category of scientific research. Qian Xuesen divided modern science and technology into four levels: Marxist philosophy level, basic theory level, technical science level, engineering technology level. He believes that aesthetics belongs to philosophical chromatography. The theory of literature and art belongs to the level of basic science or applied science, while cultural construction belongs to the technical level of transforming the objective world. Qian's research focuses on art and science, and focuses on new art forms and artistic creation methods, especially artificial intelligence art.

Li Zhengdao once pointed out: "The relationship between science and art is closely related to the duality of wisdom and emotion, the aesthetic appreciation of art and the understanding of scientific concepts need wisdom, and the subsequent sublimation of feelings and emotions are inseparable." Li Zhengdao believes that science and art are inseparable, they are like two sides of a coin, the common foundation of the two is human creativity, the pursuit of the goal is the universality of truth. Academician Yan Jiaan believes that art and science have commonalities, their main commonality is the pursuit of universality and permanence, in the creator's pursuit of "truth" and "beauty", science can seek "beauty", art can seek "truth". The second commonality is that the creation of both requires wisdom and emotion. The third commonality is that they have a common aesthetic criterion - "innovation", "realm first, technology second" and "harmony and simplicity". Wu Guanzhong believes that the combination of art and science is the combination of thought, the thought of art and the thought of science, the imagination of art and the imagination of science, the fantasy of art and the fantasy of science are connected, is the communication of ideas, to achieve the unity of thought.

2.1 Art and science are closely linked

The marriage between art and science has experienced three glorious periods, namely, the Ancient Greek period, the Renaissance period and the contemporary society.

Euclid's geometry, Archimedes' lever principle and geocentric theory emerged in ancient Greece. These mathematical methods and mathematical thinking became the basic principles of artistic creation in that era. In painting, sculpture, architecture and other aspects, artists paid great attention to the proportional relationship of works. The Pythagoreans of the 6th century BC believed in proportion, symmetry, rhythm and rhythm in mathematics, and believed that "beauty is harmony through mathematics" and that this was the root of everything in the universe. At the same time, the Pythagorean school believed that the movement of celestial bodies also had certain aesthetics, and put forward the ideas of "celestial music" and "cosmic harmony". In the 4th century BC, the ancient Greek mathematician Eudoxus discussed the problem of the golden section. The division ratio of 0.618 makes the human body more coordinated and aesthetic, and makes the works full of harmony. This view has great aesthetic value. The Golden section ratio has been used until now and has become one of the criteria for contemporary figure painting creation. The ratio of the head to the human body proposed by Poluclitus 1:7, the ratio of the head to the body proposed by Leucipos 1:8, and the Parthenon column with strict proportions and forms are excellent proofs of the pursuit of scientific proportions by the ancient Greeks. In the classical period, ancient Greek artists had already begun to deeply explore the composition and anatomy of the human body, and gradually no longer satisfied with the harmony of proportions in their paintings, and shifted the focus of

creation to the bones, muscles and structures of the human body. For example, Miron's representative work "Discus Throwman" (see Figure 1), Phidias's work "Three Goddesses of Fate" (see Figure 2), etc., these sculptures have broken through the old rigid style of the era and become a model of harmonious beauty.



Figure 1 Miron the Discus Thrower



Figure 2 The Three Fates

During the Renaissance, art and science were more closely integrated. From the 14th century to the 16th century, the rapid development of natural science, Copernicus's heliocentric theory, Galileo's breakthrough in physics, Brunelleschi's discovery of linear perspective, etc., made the pace of progress of natural science accelerated. Religious theology began to abdicate, and natural science came to dominate. The achievements of the methods and principles of the natural sciences were applied to the field of art, developing perspective in painting, the method of light and shade, and the anatomy of the human body.[1] For example, Michelangelo's fresco "Genesis" contains a large number of human bodies and Da Vinci's hand-drawn human body drafts. In order to study the structure and muscles of the human body, Michelangelo and Da Vinci did not hesitate to dissect human corpses in violation of ethics and recorded them in their manuscripts. The medical knowledge gained through dissection was far ahead of the basic social cognition at that time. Renaissance artists not only used scientific achievements in painting, but also broke through the cultural psychological barrier of artists and promoted the innovation of artistic forms, creative ideas and creative methods.

In contemporary society, the combination of science and art is more tight and close, achieving artistic peaks one after another. Art and science have emerged cross-field integration of innovation, both of which are not only limited to applying scientific thinking or scientific methods to artistic creation, but also serve specific scientific and technological forms or means for the final presentation effect of art.[2] In the 21st century, the outstanding digital technology, artificial intelligence, multimedia interaction and other technologies are changing with each passing day, which directly accelerates the change of expression forms in film and television, music and dance, comprehensive material painting and other art categories. The interweaving of art and science also gave birth to the specialty of "Art and science" under the category of art studies.

2.2 Influence of science on art

2.2.1 Science indicates the direction of art development

The invention and use of the camera in the early 19th century impacted the realistic artist group in the society at that time, making the documentary painting work lose the favor of human beings, artists passively began to think about the meaning of painting, and seek a new artistic path other than realistic creation. As an art school that cannot be ignored in the history of Western art, Impressionism broke through the heavy realistic shackles and gradually got rid of the realistic art style. The artistic style of Impressionism paid more attention to the change of light and the use of color in the picture. The development of Impressionism also laid a solid foundation for the birth of later modernism. From this, it can be seen that science has to some extent pointed the way for the development of art. The following figure shows the use of scientific principles in Chinese and Western painting. (See Figure 3)

The Application of Science in Chinese and Western Painting

	Author's Name	Development of specific scientific theories	Classic works/books
the West	Leonard da vinci	Perspective	The Last Supper, The Virgin Mary of Iwata
	Leonard da vinci	Anatomy	Saint Jerome, Standard Map of Human Body Scale
	Leonard da vinci	The theory of imitation	The Mona Lisa
	Leon B. Alberti	Perspective	On Painting
	Biro Dela Francesca	Perspective	Perspective of Painting
	Durer	Geometric line perspective method	Design of an urn for ashes
	Hobbema	Focus perspective	The Forest Path
	M.E.Chevruil	The theory of the mixing effect produced by color contrast and color and tone juxtaposition	On the Law of Color Coexistence and Contrast
	Sinek	1. For pure pigments, 2. For the separation ability of different components, 3. The ability to balance some components and their coordination, 4. The ability to choose strokes with appropriate frame sizes	Delacroix and New Impressionism
	seurat	1. Independent segmentation of color points, 2. Visual principles and composition	Sunday Afternoon on Big Bowl Island
	Picasso	Multidimensional space	The Girl in front of the Mirror
	duchamp	The "Simultaneity" Principle of Futurism	The Naked Woman Descending the Stairs
	M. C. Escher	Mathematical logic	Relativity, Rise and Fall
China	Zong Bing	Perspective consciousness	Preface to Painting Landscape
	Gao Xi	Perspective rule	Im qian gao zhi
	Han Zhuo	Psychological visual effects in spatial perspective	The Complete Collection of Mountains and Rivers
	Li Rongjia's	Boundary Drawing - Drawing and Design Plan	Han Yuan Diagram
	Xie he	The Mathematical Method of "Ying Wu Xiang Xing" in Ancient Chinese Painting	Record of Ancient Paintings
	Xu Beihong	Sketching, body proportions	Yu Gong Moves Mountains

Figure 3 The Application of Science in Chinese and Western Painting

Later, the Dutch painter Escher in the 20th century used a lot of basic scientific knowledge in the process of painting creation. His works seem absurd, but the composition and overall picture effect have been calculated and refined with strict mathematical and physical

knowledge, thus creating a new visual language in his works.[3] Escher is good at creating a three-dimensional sense of space through two-dimensional painting. His works "Encounter" (see Figure 4) and "Relativity" (see Figure 5) place the originally impossible world in the same picture and rationalize the fusion. This "impossible world" is not made up out of thin air, but a series of established elements in the picture are repeatedly constructed according to complex mathematical principles. To rationalize things that go against the laws of nature and make them appear in the picture.



Figure 4 Escher's Encounter



Figure 5 Escher's Relativity

2.2.2 Science Changes Artistic Expressions

Usually, people will choose to watch cultural relics and art works offline or look for relevant information online to browse. With the vigorous development of network intelligent technology, a new way of visiting museums, art galleries and scenic spots has emerged, which is often called VR reality technology. (see Figure 6) VR technology scans, records and stores the space. The three-dimensional scene of space is reproduced through data processing. Visitors can break the restrictions of time and space, and enjoy all-round, all-round and multi-level sightseeing through app software like entering the field (see Figure 7). This new exhibition mode breaks the multiple restrictions of traditional geographical, time, culture and other factors, and also enriches the exhibition forms of video art, painting art and murals art.



Figure 6 VR tour of digital Dunhuang website



Figure 7 Dunhuang VR real scene

In 2020, the COVID-19 broke out and spread globally. Contactless and intelligent services became the basic attributes of economic life, culture and education, and social management. Therefore, the dissemination and services of museums and art galleries are increasingly turning to online. In the context of the epidemic in 2020, museums were generally closed for a long time, but China still launched over 29000 display exhibitions. In recent years, people have gradually adapted to the new form of online art exhibitions, allowing people to feel the charm of art without leaving their homes. And these museums, art galleries, and scenic spots also provide personalized customized services for visitors, which can be improved at any time based on their preferences, viewing time, travel paths, etc., to provide better assistance. At the same time, this has also optimized the exhibition hall, helping it to partition the exhibition hall, design the movement line, navigate the audience, allocate time and staff, and obtain first-hand information. (see Figure 8).

Representative technologies: 3D scanning/3D printing technology, virtual reality (VR), augmented reality (AR), mobile development technology

Usage scenario: Cultural relics/artwork display, landscape tourism, art/cultural education scene services

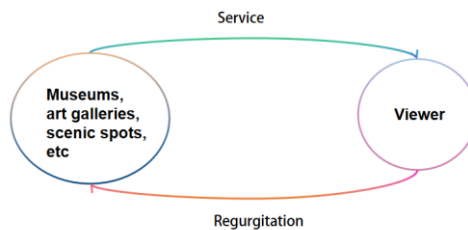


Figure 8 The relationship between online exhibition halls and visitors

2.2.3 Science affects the means of artistic creation

Modern Chinese painting still takes traditional painting as its form of creation. With the leap of Western advanced thought, the renewal and progress of science and technology, and the rise of national industry, the public gradually realized that thousands of things in life not only need to meet the needs of survival, but also need to have a certain aesthetic. The wave of Chinese cultural confidence rises, creating Chinese brands, telling Chinese stories well, and making products with Chinese characteristics and Chinese artistic style.[4] In this context, emerging technologies and Chinese-style design came into being. For example, the dynamic posters and logos of design products are no longer limited to the past Posting forms and paper materials as carriers, but are now closer to the Internet, digital carriers, precise user interaction, etc., and the display method is more concrete and accurate. Digital multimedia technology and poster art organically combine to realize the organic unity of science and technology and art communication. The power of digital technology is driving the rapid development of design. Another example is the endless number of popular immersive art exhibitions in recent years. Artists use new means such as installation, video and audio, special effects and game technology to integrate their own creative ideas and emotions into artistic creation. By creating a specific artistic atmosphere and interacting with Settings, aesthetic audiences can be integrated into them and bring immersive art experience.

2.3 Influence of art on science

2.3.1 Art provides inspiration for scientific progress

Art comes from life and is higher than life, art works often have a lot of unimaginative thinking, and art is very close to the word "creation", art on the basis of life to play the imagination, shaping ahead of the era of science and technology imagination.[5] Ancient Chinese novelists and painters often depicted scenes and fantasies in which characters ascended to the sky and the earth. It is because of the influence of these works of art that man conceived the idea of exploring the earth, the sea, and the sky, and thus acting on the production of the world.

The Eastern novels are full of wishful thinking, and the Western art development also has outstanding rational representatives. As one of the three Renaissance masters, Da Vinci is not only excellent in Madonna painting, but also unique in the study of music, medicine, mathematics, astronomy, etc. (see Figure 9) Da Vinci drew a large number of manuscripts during his life, which can be called a great master. Tank drawings, satellite maps, automatic winding machines, testing wire tensile strength machines and related basic principles (see Figure 10) designed by Da Vinci through rational thinking have been introduced into the manufacturing industry, providing a direct and powerful boost to the development of manufacturing science.

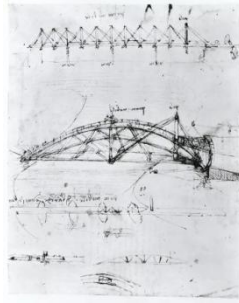


Figure 9 Drawings by Da Vinci

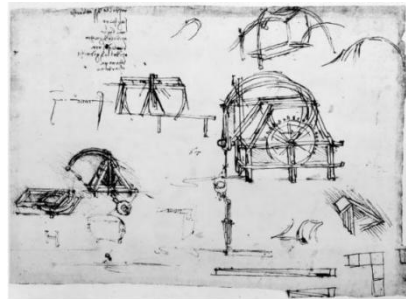


Figure 10 Drawings by Da Vinci

2.3.2 Art helps to understand scientific knowledge

Every year, a large number of children in our country have low resistance and are infected with influenza virus, in order to improve the understanding of influenza virus among young people. Some artists create illustrations related to the flu, using illustrations as a medium to convey the illustrated content is easy to understand. Directly and clearly communicate to people the source of influenza, transmission path, prevention measures, etc. It aims to help teenagers understand the scientific knowledge related to influenza, so that more groups realize that timely prevention in the high incidence season, and timely treatment after infection with influenza can be recovered by keeping calm, and improve the cognition of all teenagers for influenza virus.

3 The second chapter is the difference between art and science

George Sutton believes that the development of science is gradual progress, the scientists behind always know more than the scientists before, and the descendants continue to enjoy the scientific achievements of their predecessors.[6] The development of art is one mountain after another, it is difficult to say that contemporary artists must be higher than the previous artists, there is no distinction between high and low art, art does not have progress or regression. Kuhn believes that science and art are things whose ends and means are exactly reversed, and the artist's purpose is to create aesthetic objects, and to use certain technical means in order to

create. Scientists, on the other hand, often use artistic techniques and aesthetic tools to solve technical problems. Luria believes that the purpose of art is to share and transmit feelings and emotions, while the purpose of science is to share truth.[7] Huxley also said that the aim of science is to express in thought the eternal order of things, while art is to express in emotion. Althusser divided art into ideological art and real art, ideological art is mediocre and degenerate, is not connected with science.

Science, as the sum of human knowledge to understand the objective world, and art, as the highest form of human aesthetic creation, are different from each other. To obtain truth, science must reveal the objective laws of the development of things, such as the law of gravitation. Art, on the other hand, seeks beauty to meet people's spiritual and cultural life and aesthetic needs. Science uses more abstract ways of thinking and emphasizes rational factors. It is required to treat things objectively and calmly and reveal the nature of things. For example, for the mysterious black hole power, scientists through detailed calculation, through the cosmic space-time phenomenon to emphasize its existence, the nature of the black hole is a kind of celestial body with great curvature of space-time. Art needs to use perceptual thinking and emphasize emotional factors. It is a kind of subjective creative activity, which can reflect life and evaluate life and personal feelings. For example, performing artists often bring themselves into the situation in the script when performing, and integrate themselves into specific characters in order to express the life and emotions of the characters, so as to better present the emotions and character characteristics of the characters to the audience. Scientific theories have universal significance and are universally applicable, while artistic achievements are original, unprecedented and difficult to be copied.

4 Chapter three: Scientific penetration in traditional Chinese painting

4.1 Science promotes the progress of painting materials

The silk unearthed in Mawangdu (See Figure 11) is the earliest painting base material unearthed in China. The birth and development of paper-making technology in the Eastern Han Dynasty greatly promoted the progress of the painting industry, and the birth and application of paper replaced silk and silk as a new painting creation carrier. In Sui and Tang Dynasties, the handicraft technology was excellent and the silk weaving technology developed vigorously. Painters in the Tang Dynasty also chose to paint on silk. In Song Dynasty, papermaking technology made great progress, and paper painting and silk painting became the mainstream of society. In the Ming and Qing Dynasties, the scientific and technological level of the papermaking industry was unprecedented, and the dyeing technology, drying technology and printing technology appeared to a new height, thus paper surpassed silk and became the main base of Chinese painting and occupied a dominant position.



Figure 11 "Figure Royal Dragon Painting on silk unearthed in Mawangdui

In the Sui and Tang dynasties, the pen making technology gradually improved, and the material of the brush brush began to distinguish between the brush brush and the brush brush. With the further development of the productive forces in the Song Dynasty, there appeared works specializing in the study of the brush brush and ink stone. The pen making technology in the Yuan Dynasty was unprecedentedly strong. There is also a demand for materials, engraving technology and other aspects, and the brush inkstone reached the unity of practicality and artistry in this period. The unearthed Mawangdui silk paintings of the Warring States Period show that ancient people had already begun to use natural pigments for color during that period. The pigments for Chinese painting were mainly from grinding natural minerals into powder, extracting colors from plants, soaking insects for grinding, and grinding gold and silver into powder.[8] Before the Tang Dynasty, the technology was not developed enough, and the mineral pigments were used for flat painting. Since the Tang Dynasty, the plant pigments were developed in dyeing and weaving technology and began to be used in Chinese paintings. The plant pigments were more delicate, and the covering power was slightly weak.

4.2 Science promotes the improvement of painting techniques

As an expression of their inner feelings, most ancient Chinese paintings do not pay too much attention to rigor in painting. However, there is a type of painting in Chinese painting that moves within the criteria of the rules - boundary painting (see Figure 12). Boundary painting in the drawing of the building to the boundary rule to lead the line, according to the boundary rule to draw a uniform line, making the building in the structure and shape of the extremely accurate (see Figure 13), which is rare in ancient Chinese painting mathematical methods and mathematical thinking.



Figure 12 Li Rongjin's Han Yuan Diagram



Figure 13 Li Rongjin's Han Yuan Diagram

Since the 19th century, China began to accept Western ideas and technology, Western learning began to spread to the east, and new ideas have impacted all aspects of Chinese people, art is no exception. In the aspect of art, the western method of light and shade, perspective and realism have constantly influenced traditional Chinese painters. Xu Beihong, as a representative, chose to take the path of realistic painting in art (see Figure 14). He believes that sketching is the basis of all plastic arts, advocates the use of light and shade in painting, and began to appear nude figures in his paintings. In the 21st century, painting techniques began to gradually get rid of the bondage of sketch, and whether there was a sketch relationship could not be the basis for evaluating the quality of a painting. Painting can be done without any relationship between light and shade, and simple flat works also have their significance and value. The painting technique used by people can be flat painting, it can be made of texture, it can be collage, it can be any imaginable way, and the technique has gradually become a tool and medium to express the artist's concept.



Figure 14 Yu Gong Yi Shan by Xu Beihong

4.3 Science influences the development of painting concepts

From the perspective of the development of Chinese painting, the court painting in Chinese painting before the Tang Dynasty occupied the mainstream, and the main purpose of painting was to record the historical facts of the dynasty. The concept of painting was relatively conservative, and the content of painting was mainly to record the life of the royal and noble, daily rituals, and noble enjoyment. With the development and progress of ancient science and technology and the improvement of life productivity, the concept of painters changed, and the subject matter was no longer limited to the court. Paintings depicting folk and nature appeared, especially the literati paintings in the late Tang Dynasty. Most of these paintings pursued the

description of nature, expressed the subjective intention of the author and emphasized the expression of inner emotions.

In modern times, China's national industry began to develop, advanced western technology was more widely introduced into China, and the concept of painting also had a major turning point. Xu Beihong advocated that painting should be practiced from Western drawing, which had a certain impact on the relationship between teachers and students of traditional painting, and a large number of artists understood painting art from the relationship of drawing. The concept of focal perspective has been more widely used in painting. As contemporary ideas become more open, people begin to realize the drawbacks of certain technologies, and artists begin to pursue contemporary art that expresses their own emotions and ideas or criticizes society. The creation of painting reflects the contemporary nature, rather than pleasing others or pursuing beauty, it becomes more radical and advanced. In order to explore inner or philosophical questions (see Figure 15), it is not even given any meaning at all. Contemporary painting has abandoned the idea that art is equal to beauty, and the creation has begun to be based on their own cognition and feeling of the world.(see Figure 16) Everyone has the right to express their thoughts and ideas independently through art.



Figure 15 Lu Yushun's Lu Yushun's landscape paintings

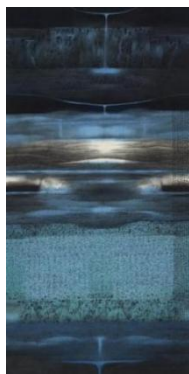


Figure 16 Lu Yushun's Lu Yushun's landscape paintings

5 Peroration

Art and science are interrelated and influence each other. Science has influenced the direction of artistic creation and promoted the emergence of new forms and means of expression of artistic creation. Art also influences science, promotes scientific inspiration, and enables the public to better understand scientific knowledge through graphic displays. However, art and science are very different from each other in terms of thinking Angle, pursuing goal, cognitive process and aesthetic experience. Art and science are both connected and different, we need art to meet our aesthetic needs and spiritual needs, but also need science to constantly innovate and develop productivity technology, so that production and life become more convenient. For Chinese painting, science not only increases the material basis for innovation and creation, but also enables the creators to obtain new breakthroughs in concepts, breaking the creation form of traditional Chinese painting, using the combination of Chinese and Western or new techniques to broaden the innovation of Chinese painting, so that Chinese painting has a new look driven by the new era.

References

- [1] Zhang Siqi. Analysis on the relationship between Art and Science [J]. Cultural Journal,2021(02).
- [2]The art and science of extended deep plane facelifting[J].JAAD International,2023,1137-.
- [3] Julie G .Art and science: close cousins or polar opposites?[J].Nature,2023,
- [4] H R K .Art and science meets moral relativism.[J].The Angle orthodontist,2023,93(6):747-748.
- [5] Lessons from the Art and Science of Negotiation[J].Negotiation Journal,2022,38(4):623-629.
- [6] Dennis Y ,V. P D . POEM Controversies: State of the Art and Science[J].Foregut: The Journal of the American Foregut Society, 2022,2(3):268-273.
- [7] S A D.Learning the Art and Science of Diagnosis.[J].JAMA,2022,327(18):1759-1760.
- [8] Gregory W R ,Henfridsson O . Bridging Art and Science: Phenomenon-Driven Theorizing[J]. Journal of the Association for Information Systems,2021,22(6):1509-1523.