

Leonardo's Visual Presentation That Combines Art and Science

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Abstract. The interdisciplinary combination of art and science has gradually become a hot topic in today's society, and Leonardo da Vinci is regarded as the core representative master in this field. When scholars study Leonardo's achievements, they mostly start from the perspective of "imitating nature", and few people focus on his innovative visual presentation methods. Therefore, this article takes Leonardo's hand anatomy manuscripts as the research object, using the comparative analysis method of hand anatomy manuscripts and Dürer's "Praying Hands", as well as the iconology analysis method, to systematically explore the visual presentation methods of his artistic and scientific combination, and further analyze the relationship between art and science. The research finds that Leonardo's visual presentation methods have innovated and combined disciplines in aspects such as composition, painting methods, and core concepts. Under the integration of science and art, Leonardo transformed science into a new visual presentation method that combines aesthetic and research exploration. It emphasizes the mutual development and complementary relationship between art and science.

Keywords: Leonardo Da Vinci, Visual Presentation Method, Art and Science, Comparative Analysis Method

1. Introduction

Science and art were intimately integrated from the Renaissance period to the age of exploration. Although the arts and sciences parted ways during the twentieth century, there is a growing movement to reintegrate these approaches to interpreting nature [1]. Leonardo's innovative visual presentation method is a powerful example of this issue. This research is of great significance for the topic of the integration of art and science in Leonardo's works. In both their biographies, Martin Kemp as well as Carmen C. Bambach made in-depth and precise analyses of anatomical manuscripts and visual presentations of Leonardo. They seldom however exposed the connection between art and science behind these works. One such scholar was Ziqing Liu who paid attention to visual presentation style of Leonardo, which effectively integrates art and science, though he only discussed it, relying on the study of manuscript images and textual materials [2]. Scholar Xiaotong Liang concentrates on the interdisciplinary thought of Leonardo and his deep thinking on the correlation between science and the liberal arts, instead of the dialectical relationship of the two [3].

Additional research of the artistic and scientific correlation of the visual presentation style by Leonardo is of great importance towards the growth and application in interdisciplinary field.

The manuscript of Leonardo hand anatomy has been used in this study, and the emphasis has been placed on. Focusing on the innovative visual presentation methods he employed, as well as the artistic and scientific relationships it conveys behind them. Through the comparative analysis, it is possible. Method, the hand sketches of Leonardo da Vinci and Dürer's Praying Hands were matched. This brought out the visual features that the manuscript held and the value of the combination of arts and science. Simultaneously, this article also uses the iconology analysis method and literature analysis method, which helps to conduct a more detailed visual analysis of the work and takes in the brilliant opinions of other thinkers [4]. This paper finally attempts to answer the It is in this visual manner, and to expose the connection between art and science behind it, that art history issue Can science be regarded as an art or a new form of visual expression?

2. Leonardo's breakthrough in anatomy

Anatomy and art and painting and sculpture, science, art - between old and new.

they are now, as it were, intertwined branches, and strengthening and encouraging one another. The works of the sculptors of ancient Greece were already filled with the observances of the human body structure and proportions even on the images of the ideal beauty. Although at that time the observation of the human body was aimed at achieving ideal balance and perfect proportions, it was not a true combination of anatomy and art, but the artists had already planted the seeds of curiosity about the human body. As a science that entails the description of forms, anatomy required images, especially images-given the expanding cultural horizon-that could be reproduced in print [5]. In the first batch of printed anatomy books, the artists merely acted like craftsmen, engraving the already established anatomical images onto wooden plates for printing. At that time, the anatomical knowledge concepts developed by the doctors were basically consistent in the images. What the artists did was to apply the given images in a different way, with little innovation or research on the patterns provided by the doctors.

It was not until around 1470, when the Florentine artist Antonio Pollaiuolo created a nude male combat work, that the artist freely depicted the beauty of the human body's movement muscles. At this point, in the visual appreciation, the reverence for the human body became the main theme of the work. It emphasized the 'mimesis' of the Renaissance, which was an imitation of the deep inner structure and principles of nature.

During the peak of the Renaissance, artists did not merely view anatomy as the fundamental knowledge for painting and sculpture, or consider art as a visual tool for studying anatomy. Instead, they believed that "anatomy is not only a science, but it is also an art in itself [6]. "This is particularly prominent presentation in the anatomical manuscripts of Leonardo da Vinci, a "universal" artist during the Renaissance. Under the guidance of his predecessors, Leonardo further integrated art and science in anatomy. Vasari praised him as "the first person to spread the light of wisdom to anatomy." [3]. In 1483, Leonardo began his research on the fundamental theories of painting, with the most important aspect being the study of human anatomy. Compared to his predecessors, Leonardo's breakthrough mainly lay in the fact that his research methods focused on conducting personal dissections of humans and animals. The research subjects, based on the principles of proportion and the appearance of the human body, also incorporated the principles of organ operation and individual studies of important organs, such as the skull, heart, hands, etc. As well as creating a new visual presentation method that combined art and science. This new method involved adding artistic depictions such as light and shadow volume to medical anatomical

diagrams, and emphasizing the scientific research value based on the sketches of human hands. This article also focuses on studying this new visual presentation method that combines beauty and science.

3. Leonardo's unique visual presentation

3.1. Visual analysis

Leonardo's "Research Manuscript on the Mechanism of the Hand" (see Fig. 1) was created between 1510 and 1511 and is included in "Anatomical Manuscript A". It is currently housed in the Royal Library of Windsor Castle. It is an anatomical draft depicting the hand, which includes five sketches showing the bones and muscles of the right hand, as well as six smaller pictures of fingers and explanatory annotations. It clearly shows the interweaving of tendons and their operation methods, and transforms the muscles into strings to highlight the mechanical relationships. The drawing direction of this manuscript starts from the lower left to depict the bones of the hand, then adds the deep muscles and tendons of the palm and wrist on the lower right, adds the first layer of tendons on the upper left, the second layer of tendons on the upper right, and finally the two small pictures in the middle are different hand postures from different angles. There are also several small drafts of fingers and detailed textual explanations of the images. This manuscript is a typical representative of Leonardo's artistic and scientific expression methods. It was drawn with black chalk, pen and ink, and to depict the delicate internal space of the palm, the water-washed painting technique was also used.

Leonardo had always been deeply interested in the functioning principles of the muscles and bones in the hands. Martin Kemp once wrote: "He particularly delights in the supremely ingenious system of strings and stays in the hand, 'the instrument of instruments', as it was termed in Aristotelian tradition [7]." The hand plays a significant role in both painting and the human body. Leonardo's study of the hand was not merely out of scientific curiosity, but also to understand the working principles of tendons and bones when the hand operates, as well as the changes in muscle appearance. He applied this knowledge to painting and sculpture, making them closer to the human body depicted by the natural creator. Moreover, during the Renaissance, gestures contained rich iconographic knowledge and were an important way to convey emotions and thoughts. Therefore, the meticulous study of the hand was beneficial to Leonardo's artistic expression.



Figure 1. Leonardo Da Vinci (1452-1519) The bones, muscles and tendons of the hand c.1510-11 Black chalk, pen and ink, wash | 28.8 x 20.2 cm (sheet of paper) | RCIN 919009 [8]

3.2. Work comparison

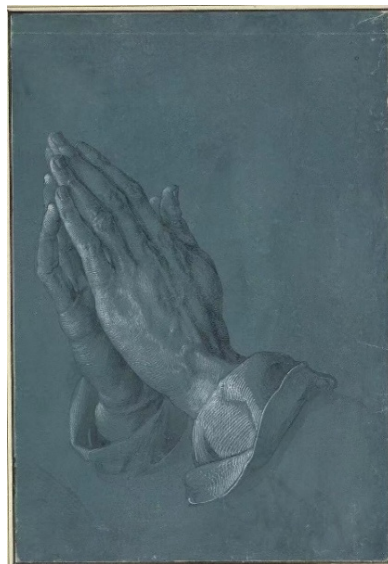


Figure 2. Albrecht Dürer, Praying Hands (Betende Hände), c. 1508. Ink and white highlights on blue paper, 29.1 × 19.7 cm. Albertina Museum, Vienna [9]

By comparing with the works of Dürer depicting the same subject as "praying hands" (see Fig 2), this article explores the differences in three aspects of the image presentation, thereby highlighting the uniqueness of Leonardo's visual presentation of his manuscripts and the close connection between science and art.

Fluid Manuscript Composition. Unlike the traditional diagonal composition in Dürer's "praying hands", these sketches in Leonardo's manuscripts are scattered in the gaps of the paper, together with the textual annotations, forming the form of a note. His manuscript was created and composed based on the scientific thinking and research sequence of his scientific studies, placing greater emphasis on the scientific logic of the composition. This is particularly evident in this hand-written manuscript. Leonardo followed the logical sequence of bones and tendons as his research sequence, and the arrangement of the exercises on the manuscript formed an inverted "Z" shape. The sequence of these hand exercises seemed not to have been deliberately and meticulously arranged, but emerged according to the needs of his thinking. The exercises were scattered in the center of the manuscript and the gaps between the paragraphs, not in the traditional triangular composition or diagonal composition, etc. They seemed random but were connected by Leonardo's inspiration and logical thinking. Bambach once wrote: "These manuscripts beyond doubt Leonardo's 'ability to accumulate facts with rational structure', and are masterpieces of synthetic thought [10]."

In the case of Dürer, in *The Praying Hands*, the work shows only one object and The main body of Leonardo's manuscripts consists of images with annotations. Had the picture been one only, its viewer would have thought of the drawing as a sketch. Nevertheless, the scientific quality of the painting image is enriched with the introduction of textual annotations. Annotation facilitates science by adding words and phrases that have definitions in order to relate them to the image [2]. The textual annotations communicate the content and the ideas of the research to the audience in such a way that the sketch becomes a research anatomical picture, therefore, making the text turn the manuscript into a paper laboratory used by Leonardo.

Presentation through Gradual Unfolding. Dürer's "Praying Hands" is like traditional sketches in its way that it shows an object in one piece yet it focuses on the usage of lines, to form the light, shadow and volume. But the hand sketches by Leonardo are more of a research based, layer upon layer analytical process. Leonardo favored doing it, unlike the multi-section presentation method that is common in his manuscripts. Leonardo have followed this peeling layer by layer in his later works. He layered the palm and back of the hand of the simplest bones, in turn showing the inner layer by layer anatomy of the hand, which enables the viewers to see the details during every step quite clearly. At a concurrent, despite the fact that this way of presentation removes the powers of the viewers identify with the reality, it emphasizes the scientific element of the piece of art work even more. This presentation technique is more friendly to the academic study, but it does not deprive this work of its aesthetic value. It is a combination of the beauty which is perfect of science and art, the vivacious form of the hand.

The Core Pursuit of the Work. For Dürer, his exploration of nature and pursuit of perfect painting effects were mostly for the service of God. Piousness and suffering were the core of Dürer's spirit, and they were also the fertile soil for his talent [11]. The personal feeling and the connection behind the *Praying Hands* painted by Durer are primarily founded on the iconographic sense of the praying gesture. His weathered and hands of bone hug each other, and this is the whole deep emotionality of a prayer and piety. Their emaciated fingers proved in the case of religious painting in early Christianity, their god-love, their passionate seeking, and the hands in praying in together position were a sign by which Christians indicated their religiosity and hopes. Hence this apparently naive hand drawing suggests a religious faith and an ardent religious conviction. filled emotional utterance of hope. But the divine emotional way of this sketch still follows through with the iconographic meaning of traditional sketches.

In comparison, Leonardo's hand anatomical sketches, although depicting hands as well, had a direct purpose of studying and learning the internal structure of the hand and understanding its

movement principles. This made it easier for him to later create more accurate depictions of the human body's true form and truly understand this sacred human part, highlighting the humanistic thought. Leonardo focused on the scientific anatomical knowledge and the mechanical relationship between tendons and bones in his study of the hand sketches, rather than artistic expression or iconographic meaning. Therefore, the visual presentation of this sketch serves this purpose, emphasizing the combination of art and science rather than the expression of texture.

4. Leonardo's art and science

4.1. The visual presentation style of science

In Leonardo's "Treatise on Painting", he once discussed, "Is painting a science? Science is reasoning based on the final elements, and points are the initial elements of geometry [12]." On the contrary, can science be regarded as an art or a new form of visual expression? This article takes Leonardo's hand-drawn manuscripts as an example and analyzes that: under the integration of science and art, science can be transformed into a new visual mode that combines beauty and research exploration, such as anatomical diagrams, mechanical design drafts, etc. In this visual presentation mode, art becomes a research tool for science, and artists conduct experiments on the drawing paper, using various sections or layer-by-layer peeled methods to deeply study their objects. At the same time, science also adds academic research rigor to artistic expression. Martin Kemp once wrote: "The remarkable range of graphic techniques he was forging granted fresh cogency to his arguments about the superiority of the image over the word [7]." Unlike the traditional and classical sketching expression, this visual approach emphasizes its scientific research nature, aiming to promote the dual disciplines and dual fields of science and art. This visual presentation method is a direct expression of the combination of art and science, a product of the Renaissance era, and also the wisdom of Leonardo, the "all-round interdisciplinary expert". Under the combination of artistic visual aesthetics and the rigor of scientific academia, science has transformed into a new visual presentation method, while art has also initiated a new application mode, with more rational light added to the sensibility.

4.2. The relationship between art and science

During the Renaissance, art and science were not clearly separated. Artists would imitate nature or real human bodies during their artistic creations, so science held a crucial position in art. As a result, Leonardo and other artists' outstanding artistic expressions in scientific research gradually made art become a tool for scientific research, clearly presenting its process and results. Whether in the contemporary era or during the Renaissance, art and science were not opposed or separate; instead, they were closely integrated in the profound observation of nature, curiosity for knowledge, and respect and reproduction of the real world, mutually promoting each other and jointly constituting the core driving force of that great era in exploring the world, understanding human nature, and pursuing truth and beauty. At the same time, in the process of conducting scientific research using art as a tool, people also explored the natural world, drew inspiration, continuously learned and improved scientific principles, and promoted the development of science.

5. Conclusion

The research results of this study indicate that Leonardo's innovative visual presentation approach pays more attention to the integration of art and science in the manuscript composition, depiction method, and core concept. This further leads to the conclusion that art and science are mutually reinforcing and complementary. Science lays the foundation for art, and art provides new research methods for science. Under the combination of art and science, Leonardo presents science in a new visual way that combines beauty and research exploration. This study provides many valuable references for future research in this direction. Mainly using the comparative analysis method, from the perspective of visual presentation, it promotes the research on Leonardo's art and science. Future research should focus more on studying Leonardo's research ideas and artistic and scientific thinking from the arrangement order of manuscripts and the drawing order of single pages. From more different directions to deeply study the artistic and scientific combination of Leonardo's wisdom.

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