

Exploring the Application of Scientific in Artistic Creation During the Renaissance

Zerui Chen

Beijing National Day School, Beijing, China

1811020211@stu.hrbust.edu.cn

Abstract. During the Renaissance, Western Europe experienced almost no development of culture and science in the previous medieval period of nearly 10 centuries, starting from Florence in Italy and spreading to the whole of Europe, people began to pursue and explore the art, science, and even philosophical thoughts of classical Greece and Rome, forming the world view of ancient Greece. During the Renaissance, many artists were also able to read texts from various fields, and thus incorporated knowledge of the natural sciences, such as biology and anatomy, into many works of art. What led these scientists to take their knowledge of the natural sciences, especially biology and anatomy, and apply it to their art? This paper takes Leonardo Da Vinci and Michelangelo as examples and analyzes their three works: *Madonna of the Rocks*, *Vitruvius Man*, and *David*, as well as their experiences before they became famous, and combines the background and ideological characteristics of the Renaissance. It is concluded that the reason why artists can integrate the knowledge of biological anatomy into artistic creation is not only to make their works more real, more restorative, and more beautiful but also to explore nature and reflect academic diversification under the influence of "humanism".

Keywords: Anatomy; Renaissance; Naturalism; Humanism.

1. Introduction

Before talking about the Renaissance, it is also very important for European history to transition from the previous stage to the historical period of the Renaissance, which can be said to have contributed to the French and commercial Renaissance and the beginning of European modernization to a certain extent. Therefore, before introducing the Renaissance, this paper will briefly introduce the Middle Ages in Europe. The term was first used by the Italian humanist Biondo during the Renaissance. Humanists defined the Middle Ages to separate their era from the nearly 1,000 years of history that preceded it [1]. By the Middle Ages, the Western Roman Empire had collapsed, while the Byzantine Empire lasted nearly 1,000 years. During this period, Western Europe experienced a brief period of unity but a long period of division, and the Catholic Church was powerful [2]. Neither the arts nor the natural sciences developed much during this period, and there was no inter-disciplinary integration. However, the ideas of the Middle Ages and the artistic and historical patterns based on the ideas have influenced the development of European history, making it a very important stage in European history.

In the European Renaissance from the 14th to the 16th century, the artistic and scientific ideological movement that began in the Italian peninsula and spread to the whole of Europe to promote the beginning of European modernization was different from the religious background behind the Middle Ages and put forward "humanism". While "humanism" convinced Renaissance artists of the importance of human values, it also aroused their interest in classical Greco-Roman art and science, which should focus on the beauty and truth around people in this world, so art, philosophy, and natural science spired and collided during this period [3].

This article takes two of the most iconic artists of the Renaissance, Leonardo Da Vinci and Michelangelo, and explores why they combined biology and anatomy with art and the natural sciences. Leonardo Da Vinci, born in Anchiano, Italy, on April 15, 1452, was a polymath of the Florentine Republic who mastered painting, planning, physiology, physics, and engineering. As one of the most



representative figures of the Renaissance, he created countless artistic and scientific treasures during his life, such as the *Madonna of the Rocks*, *Mona Lisa*, the *Last Supper*, etc., and his paintings also reflected a rich knowledge of biology and anatomy. Michelangelo, an artist born in Italy during the heyday of the Renaissance, refined his sculptural skills and also integrated a large amount of anatomy and human structure knowledge into his sculptures and large-scale paintings, such as his masterpieces *David* and *Genesis*, which reflected a large amount of anatomy and human structure.

2. Technique Analysis of Artworks

This article first focuses on Leonardo Da Vinci and his representative works. Leonardo, as one of the most famous artists and scientists of the Renaissance, created countless classics, but the magic thing is that Leo Da Vinci was not only skilled in artistic creation, but also quite knowledgeable in the field of anatomy and human structure, and integrated a large number of anatomical elements and his research results into his paintings.

2.1. Analysis of Da Vinci's Works

To explore the reasons and compare them to other Renaissance artists, this paper selects two Da Vinci masterpieces, *Madonna of the Rocks* and *Vitruvius*, to analyze the combination of anatomy and art in Da Vinci's creation and explore the reasons for the combination.

There are two extant paintings of the *Madonna of the Rocks*, one is kept in the National Gallery in London, England, and the other is in the Louvre Museum in Paris, France. This article will select the edition stored in the British National Gallery for analysis.

The *Madonna of the Rocks* is one of Da Vinci's most complex large-scale paintings and was commissioned while he was in Milan [2]. Throughout the whole painting, as Fig. 1 shows, Da Vinci painted the figure elements in the middle of the painting, and these figures are surrounded by many plants and rocks, as well as distant rivers and mountains. In the middle of the painting, the Madonna is wearing blue and yellow robes, and the baby on the left of the Madonna is St. John with a cross in his hand. To the right of the Virgin is a chubby, cross-legged child, followed by a kneeling angel. These three characters are incredibly reductive and realistic and are in silent communication. And angels are here to serve as witnesses from heaven [4]. The characters are also surrounded by a large number of very realistic natural scenes, such as plants, stones mountains, and rivers in the distance in the fog. In Da Vinci's works, one can see that a large number of anatomical and biological features are integrated into the carving of the five features of the characters, as well as the depiction of the surrounding plants, mountains, and rivers, making the whole painting very detailed and real. He uses a kind of aerial perspective in the background, where he draws the viewer's eye by painting distant mountains blue, and around those mountains by fogs. Da Vinci's treatment of these plants is also very close to reality, and he also left many manuscripts of different parts of the plant extremely realistic. For the human characters part, Da Vinci mainly used a technique called *sfumato* to create the blurred boundary, coupled with his own accurate description of the unknown human body posture and facial shape, making the figure look very three-dimensional and very close to reality [4].



Figure 1. Madonna of the Rocks [5]

In another of Da Vinci's paintings, *Vitruvius Man*, the manuscript has no color but vividly depicts the body structure of an adult male. The vertices of the hands and feet of the two men are rounded and square. The painting is a reflection of Da Vinci's efforts to paint the human body in perfect proportions, so much so that it later became known as the "male proportions". At the same time, this painting is also a perfect combination of science, especially human structure and anatomy, and painting art. Meanwhile, to make his 2D paintings reflect 3D visual effects, Leonardo Da Vinci created three-dimensional and even perspective visual effects on his paintings through sfumato technology.

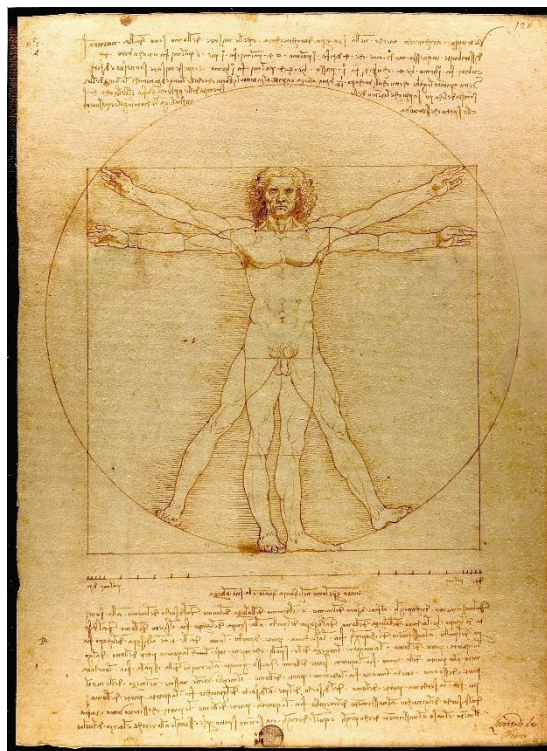


Figure 1. Vitruvius Man [6]

Another artist chosen for analysis in this paper is the famous Italian sculptor Michelangelo, who was born at the height of the Renaissance. Michelangelo is different from Da Vinci in that, in contrast to

Da Vinci's two-dimensional paintings and manuscripts, Michelangelo's main artistic creation focuses on three-dimensional sculpture [7]. Therefore, instead of creating three-dimensional sense and restoring real human structure and posture through shadows and blurriness like Da Vinci, Michelangelo needed to conduct more detailed research on human structure and anatomy, and directly try to restore real human structure and posture through three-dimensional sculptures.

2.2. Analysis of Michelangelo's Works

Among them, one of Michelangelo's most famous works is his marble sculpture "*David*" created between 1501 and 1504. The original statue is now in the Accademia Gallery in Italy, and David carved it from a single piece of marble. Michelangelo used a lot of knowledge of anatomy and even geometry in the process of sculpture. Current scholars believe that the sculpture depicts David before the battle. Michelangelo was not only incredibly realistic in restoring the true proportions of the human body based on a single block of marble [8].

Even if the facial muscles are tight, the protrusions of blood vessels in the neck and arms can be accurately restored. In addition, considering that the statue was placed on the roof at the time, David's head and left hand were larger than normal, so that people could view it from below [9].

From the above analysis of the artwork, one can see that. Both Leonardo Da Vinci, who mainly painted, and Michelangelo, the representative of sculpture art, integrated a lot of natural science, especially the knowledge of anatomy and biological structure, into their artistic creation process and final works. In the *Madonna of the Rocks*, the image of God is created based on human body shape, posture, and facial features through perspective and fuzzy accuracy, and the surrounding plant structure is painted extremely close to reality, or the perfect human body structure in the eyes of Da Vinci with three-dimensional sense depicted by Vitruvius Man. Or it is the embodiment of the incomparably real human structure, proportions and even muscles and blood vessels in three-dimensional sculpture. Why Renaissance artists incorporated a great deal of knowledge of anatomy and human anatomy into their art, and what contributed to their interdisciplinary thinking, is an interesting question.



Figure 3. David [10]

3. Combined Artistic Creation with Anatomical Knowledge

During the Renaissance, The Florentine Academy of Art had an obligatory course in anatomy, in which its students executed drawings from cadavers and skeletons, is available. In the *Lives of Artists*, Vasar (1511 – 1574), the famous painter and historian described how important anatomy was to artists: Again having seen human bodies dissected one knows how the bones lie, and the muscles and sinews, and all order of conditions of anatomy [6].

Leonardo Da Vinci and Michelangelo also had rich learning and research experiences in anatomy and biological structure before they became famous. Da Vinci acquired his first human skull to study anatomy in 1489, and between 1510 and 1511 he carried out twenty autopsies at the University of Pavia in collaboration with the professor of anatomy Marcantonio della Torre and later entered the court of Lorenzo Medici [5]. Michelangelo was also connected to the Medici family, one of the most powerful families in the Florentine Republic at the time. Michelangelo was also connected to the Medici family, one of the most powerful families in the Florentine Republic at the time. His previous mentor had been Lorenzo il Magnifico, and when Michelangelo was 17 years old after his mentor died, he started his dissections of cadavers from the hospital at the Monastery of Santo Spirito, then became part of the Florentine Center of Humanism at the Court of Lorenzo de' Medici [5]. It can be seen from their experiences that they had received systematic training in anatomy and physiology in the early stage of fame, and also had very rich experience in anatomy learning and research. So there is reason to suspect that this was a routine practice for Renaissance artists. There are two main reasons why they were trained in systematic anatomy.

Renaissance artists studied and combined the knowledge of anatomy and organism structure for their artistic creation. During the Renaissance, artists also sought to achieve a perfect sense of beauty in their artistic creations, which is why they considered a lot of geometric and biological structures in their artworks. They believe that through these scientific means, the works can be most close to the real situation and achieve "naturalism", and this restoration of the natural state is the most real situation so that the most real situation is a kind of attainable perfectionism. For example, Leonardo Da Vinci depicted the structure of flowers in such detail in the *Madonna of the Rocks* and made people look more three-dimensional through the technique of sfumato, and even detailed depictions of the features of baby fat on the arms of babies were all aimed at highlighting "naturalism" in his paintings, while the famous Vitruvius Man, not to mention the famous, Through this sketch, Da Vinci constructed the "nearly perfect human body proportion" in art, which also made the painting known as the male proportion [8]. When sculptor Michelangelo carried out three-dimensional sculpture creation, in addition to strictly restoring the proportion of the human body, he also needed to achieve the truth and "naturalism" in the strict sense by depicting the lines of muscles and blood vessels. To achieve such attest, the artist must have a certain knowledge of anatomy and human structure. To achieve their expectations of perfect beauty.

Secondly, The reason why artists return to reality is the ideal beauty in their eyes, which is that under the background of the Renaissance era, there was no religious monopoly of the Catholic Church in the Middle Ages. The proliferation of humanism has led people to pay more attention to the importance of this world and to discover the beauty and truth of the things around them in this world. Therefore, they will think that making art creation realize "naturalism" is a way for artworks to achieve ideal beauty. At the same time, humanism allowed artists in the Renaissance to explore Art without knowing it for the first time and also allowed artists to read and even write classics that were not artistic. It can be seen from the opening of anatomy courses at the Florentine Academy of Art that artists can also have an unexpected interest in art. The context of the Renaissance gave them the opportunity for these interests and truths, which is why artists were able to study anatomy during the Renaissance and were able to combine anatomical knowledge with artistic creation [7].

4. Discussion

To sum up, one analyzes three works by two of the most representative artists of the Renaissance, Leonardo Da Vinci and Michelangelo, *Madonna of the Rocks*, *Vitruvian Man*, and *David*. From these three works, one can see that artists in the Renaissance used a series of measures, such as aerial perspective and *sfumato*, to integrate artistic creation into biological and anatomical elements, so that two-dimensional paintings and three-dimensional sculptures are closer to reality in terms of body proportions and details unrelated to muscles. From the experiences of Michelangelo and Da Vinci, it can be seen that they both had very rich experiences in learning and researching anatomy. Even at that time, society and even rulers would provide opportunities and platforms for artists to learn and study anatomy. Artists learn a lot about anatomy and incorporate it into their creations for two main reasons. The first is that they want to achieve ideal beauty in their artistic creation, and they believe that the embodiment of ideal beauty is to make artworks more "naturalistic" and more natural and real in all aspects, and incorporating a lot of anatomical knowledge into artistic creation is also to make the works more joyful, real and natural. In line with "naturalism", to achieve the artist's mind of beauty.

Second, the germination and widespread spread of "humanism" in the Renaissance made people pay more attention to the beauty and truth of things around the world. So both the worldview of artists themselves and the methods of governance of governments and rulers changed. In addition to this, artists use "naturalism" to define beauty, it also allows artists to read classics in other fields and find other interests, and the government also provides a platform for artists to further their studies in various scientific fields. Humanism gives artists the courage and interest to study anatomy. In turn, it provides the theoretical basis for artists to combine art with anatomy and biology.

5. Conclusion

By analyzing the works of Leonardo Da Vinci and Michelangelo and their academic experiences. The result is that Da Vinci and Michelangelo, to make their works more restorative and have better visual effects, both have rich anatomical research and learning experiences so that they can combine anatomy and art. This paper further argues that Renaissance artists reflected naturalism to make their artworks look more realistic. This, combined with "humanism", allowed them to develop an interest in the natural sciences, giving them ideas and the ability to combine knowledge of the natural sciences with artistic creation. This provides valuable insight into the history of human natural science and art development and eventually modernization.

References

- [1] The Editors of Encyclopaedia, "Renaissance", Encyclopedia Britannica, Accessed. 4 (2024).
- [2] The Editors of Encyclopaedia, "Middle Ages", Encyclopedia Britannica, Accessed. 4 (2024).
- [3] G. Molland, Science, and Mathematics from the Renaissance to Descartes. In *The Renaissance and 17th Century Rationalism*. Routledge. (2023) 104-139.
- [4] The Editors of Encyclopaedia, "The Virgin of the Rocks", Encyclopedia Britannica, Accessed. 4 (2024).
- [5] The Editors of Encyclopaedia, "Piero di Lorenzo de' Medici", Encyclopedia Britannica, (2024).
- [6] JMS Pearce, *The Anatomy of Michelangelo (1475-1564)*. (2019).
- [7] Michelangelo's *David*: Admire World's Greatest Sculpture at Accademia Gallery, Accademia.org. (2019).
- [8] D. Nimavat, "Humanism and Naturalism in Dan Brown's 'The Da Vinci Code'", *IJELLH. International Journal of English Language Literature and Humanities*. (2019).
- [9] D. M. Thomas, D. Galbreath, M. Boucher, K. Watts, "Revisiting Leonardo da Vinci's Vitruvian Man Using Contemporary Measurements", *JAMA*. 323(22) (2020) 2342-2343.
- [10] The Editors of Encyclopaedia, "David", Encyclopedia Britannica. (2024).