



The Renaissance Artists' Understanding of Anatomy and Human Proportions and Their Application to Their Work

Yanran Xu

School of Applied Design, Shandong University of Arts and Design, Jinan, Shandong, 250000, China.

1700210729@stu.sqxy.edu.cn

Abstract. Inspired by humanist ideas and the spirit of scientific inquiry, Renaissance artists applied their knowledge of anatomy and perspective to painting. Through a combination of technical research and scientific experimentation, they sought to understand the immense potential of art. In their quest for beauty, artists were determined to explore the mysteries of the human body. They studied the proportions and harmony of the human body, looked to classical ideals for guidance, undertook extensive anatomical studies, applied perspective to their paintings and precisely defined the proportions and muscles of the human body. They studied not only the bones and muscles of the human body, but also the dynamic patterns of its proportions and forms, developing an anatomy suited to the needs of art, known as artistic anatomy. In this context, this paper explores the meaning behind the paintings of Renaissance artists by looking at their understanding of anatomy in their works as the main research question, thus gaining a deeper understanding of their innovative development of artistic anatomy. Their findings have been used in countless subsequent works of art and have informed and inspired contemporary painting and sculpture.

Keywords: human proportions, artistic anatomy, Renaissance, humanism

1 Introduction

In the Middle Ages, human anatomy was not a free subject. Only superficial studies by Herophilus and Erastia Strata were carried out, but human dissection was not abandoned. From the Middle Ages, artists secretly performed human dissections in an attempt to bring art closer to life and death, studying both intact and decomposed cadavers to understand their muscular and skeletal structure. With the growing humanist spirit of the Renaissance, a special relationship developed between art and science, including anatomy, perspective and optics, as well as inspiration from ancient Greek idealism, which gave Renaissance art many unique characteristics. Artists were particularly interested in the study of anatomy, which became inseparable from art. Artists such as Leonardo da Vinci, Michelangelo and Dürer used the study of the human body as their primary means of expression and research, and created many masterpieces based on their mastery of anatomy.

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Artistic anatomy is an inseparable field in the world of art, and the study in this paper is divided into three main sections, first examining Leonardo da Vinci's pioneering significance of Renaissance anatomy and his work, then exploring Michelangelo's understanding of the application of anatomy and his work, and finally analysing Dürer's experience of bringing human proportions and anatomical theory from Italy to Germany and his work. It becomes clear that human anatomy was no longer a cutting-edge science sought by the medical elite, nor was it a skill sought by pioneering artists. The search for the light of science and truth has freed mankind from the hand of God and restored a sense of control over its own destiny. As the pinnacle of human understanding and self-expression, human anatomy has left a legacy in human history.

2 Historical Context

In ancient Greece, with the promulgation of church decrees and the attack on idols, the anatomy of the human body became a "taboo". Therefore, the study of the anatomy of the human body became a "taboo". That is why religious painting in the Middle Ages became stereotyped, simple, formatted and unenlightened. It is a simple, non-photorealistic, symbolic art form that strives to create a solemn, sacred, holy atmosphere, which is a cornerstone for the creation of Renaissance oil painting. In a series of Christian images of medieval mothers and children, such as *the solemn images of mothers and children*, as well as *the images of mothers and children on the throne*, the Virgin and Child does not reflect the warmth between mother and child. The idol is dignified, serious and even indifferent.

In the 15th century, artists realised that in order to draw true-to-life images, they had to understand the human body, so they focused on the bones, organs and muscles under the clothes, rather than on the structure and size of the appearance, as in the Middle Ages. With the growth of human consciousness, painters seek the scale of law and coordination in anatomy, combining a scientific point of view with human anatomy; the anatomy of the human body is depicted in three-dimensional perspective and overlapping composition. Her works have the following characteristics: the beauty of realism, the coordination of proportion, the exquisite use of perspective, the exploration and study of human anatomy, and the understanding and application of anatomy. Anatomy and art have been closely linked ever since. Painters such as Leonardo da Vinci, Michelangelo and Dürer all pursued the human form throughout their lives, using it as a basis and as an object of study. They used their understanding of the structure of the human body to incorporate the warmth of the human body into their paintings, creating a masterpiece ^[1].

3 An Analysis of Artistic Anatomy

3.1 Leonardo da Vinci's Works

Leonardo da Vinci was both a Westerner and a master of world art.

The Italian medical historian Castiglioni, in his book *A History of Medicine*, states that 'Leonardo da Vinci performed extensive dissection'. According to Cardinal Allaghan, at the age of 30, da Vinci dissected several men and women, ten of whom were used for intravenous research. Leonardo da Vinci had ambitious goals. Da Vinci wanted to analyze a person from birth to death, head to foot. He planned to write 120 treatises on anatomy, physiology and comparative anatomy, but his most important work was a description of what he observed with unparalleled completeness and authenticity [2].

At the age of 14, Leonardo da Vinci was apprenticed to the famous Italian sculptor Verrocchio, where he began to study anatomy, which he continued to do from the age of 30. He began to sketch the human anatomy, hoping to understand its structure and find a more ideal way to represent the 'perfect world' of the human body. His notebooks contain around 600 sketches depicting the major organs, bones, muscles and blood vessels of the human body, and he performed more than 30 human dissections during his lifetime. A series of human skeletons, completed around 1510, demonstrates his ability to see and analyse: the curves of the spine and sacrum are of such precision and accuracy that they can be used directly for static analysis, and the musculature of the skeleton can be admired in passing. On the basis of these extant documents, clinical anatomists believe that Leonardo da Vinci's anatomical drawings were centuries ahead of his time in terms of accuracy, and he has rightly been hailed as the forerunner of modern medical and artistic anatomy [3].

In addition to his mastery of anatomy and the human body, which can be glimpsed in Leonardo da Vinci's sketching manuscripts. Moreover, the application of knowledge of anatomy and human nature is also largely reflected in numerous works by Leonardo da Vinci.

Leonardo da Vinci's works make full use of colour, light and darkness, line, anatomy and perspective to express artistic images. The most iconic are *The Last Supper*, *The Mona Lisa* and *The Madonna of the Rock*. The famous fresco, *The Last Supper*, is 4.6 metres high and 8.8 metres wide, and uses the principle of perspective to give the viewer the impression that the room is a natural extension of the picture.

Da Vinci's psychological portrayal of the characters in the biblical episode and the dramatic scenes in which the struggle is played out are profoundly evocative. When Jesus says that someone has betrayed him, the twelve disciples come in various shapes and sizes. Da Vinci depicts this dramatic moment by flexing the neck muscles of the figures. Throughout the scene, there is a clear sense of drama and conflict in the changes of mood, the expression of character, the tendency to move and the combination of figures, which is a good metaphor for the struggle between light and darkness, good and evil on earth. It is as if people can see their inner activities through their expressions. It is as if their inner workings can be seen through their facial expressions, and every character is lifelike. They are not a group of rigid people without any

movement. From the different expressions of each person, people can really feel the dynamics of the characters, as if people saw the whole process of the whole thing. How did Jesus calmly say that shocking sentence, how did Philip jump up, what mental activities did Judas have at that time? This is because Da Vinci made in-depth observation and research on human image and psychology, so that through the movement, posture, expression of the character insight into the subtle psychological activities of the character and show them. Human posture can convey emotion, and in painting human posture can reinforce and enhance facial expression, so 'writing spirit with form' involves not only 'form' but also the expression of 'form'. This precise control and application of form also benefits from Leonardo da Vinci's deep understanding of human anatomy^[4].

3.2 Michelangelo's Works

Like Leonardo da Vinci, Michelangelo developed his own personal style based on anatomical knowledge. Michelangelo spent about two years in the morgue of the Abbey of Santo Spirito, exploring the mysteries of the human body and perfecting his study of anatomy and perspective. He went on to dissect and study the dead himself, from many different angles. Unlike doctors, he was interested in the structure of the joints and the position of the muscles that could express the human body, not the internal anatomy of the human body, nor the course and shape of the veins, arteries and capillaries. There is a great deal of research into the dynamics of the body, its form and its sense of power. In the conception of a painting or sculpture, Michelangelo does not directly create a clothed form, but begins with the figure in its naked state and then, when the body is ready for consideration, dresses it in a natural and rational way. This gradual process, from internal construction to external form, became the basis of Michelangelo's unmistakable style^[5]. Unlike other artists of his period, his art stands out for its total concentration on the human body. His works are so heroic that he has been called 'the creator of the bourgeois hero', embodying the mind, will and spirituality of the figure^[6]. Michelangelo's David is a heroic figure, like the knight who defeated the dragon in Donatello's statue of St George^[7]. In his classic sculpture of *David*, for instance, Michelangelo exaggerates the posture of the human body throughout the artistic work. All of his body weight rests on his right leg, while his left leg rests on his right leg, relaxed, with a natural step to one side. Head, chest, waist, hip and legs are all turned, with legs facing forward and head turned to left, with right arm naturally down and left arm up to contrast movement and stillness^[8]. Michelangelo's approach to human anatomy and to human sinews and flesh was extremely rational and naturalistic, and he used artistic exaggeration to enlarge joints of head and lower limbs. Michelangelo's anatomic treatment of the structure of the human body and the tendons and meat of the entire body are extremely rational and naturalistic, using artistic exaggeration to enlarge the joints of the head, lower extremities, hands and feet to emphasise the heroic form. The facial expressions are vivid, with angry eyes and resolute looks, showing determination to win.

He exaggerated the entire structure of the human body and its movements. Each outline was formed by a specific musculature, and the starting and ending points of

each outline section strictly reflected anatomical proportions. The intersection of two contours meeting, which line to follow, which line to begin and end, where to make the inner and outer strokes, are all determined by the anatomical structure of the relationship at a particular angle. In his hands, the hard rock was transformed into an object of bodily fascination, an echo of the soul.

3.3 Dürer's Works

Born into a family of goldsmiths and silversmiths, Dürer loved painting from an early age. At the age of fifteen he studied painting for three years with the local painter Uhaljamt, and then, in order to become a painter, he travelled around the south for four years, where his studies and travels were intertwined^[9]. His travels and apprenticeship enabled him to reach a high level of professional skill and artistic creativity.

Dürer's early work is distinctly German in its simplicity and rationality, and in 1494 the Italian Renaissance represented a progressive, idealised style, the pursuit of which led Dürer to embark on a study tour of Italy.

During Dürer's first trip to Italy, in Venice, the painter Jacob de Barbarie showed Dürer how he had depicted the human body with the aid of a measuring system, and Dürer was interested in the opportunity to learn more, but Jacob refused, leading Dürer to return to Germany to begin his own study of human proportions, perspective and human anatomy. During this time, Dürer studied the artistic theories of painters such as Leonardo da Vinci and absorbed the Italian concept of the ideal beauty of the human body, which taught him a great deal. In order to discover the proportionality and harmony of the human body, he looked for rules from the classical ideal proportions and spent a great deal of time experimenting with anatomy.

In 1504, after completing his studies, Dürer produced his first copperplate print, *Adam and Eve*. With its almost perfect human form, drawn in extremely intricate and delicate lines, it is a work of art that has astonished the world. It shows Adam and Eve in the Garden of Eden in a rectangular composition: Adam is looking at the forbidden fruit given to Eve by the serpent; Adam's right hand is holding a leafy plant with apples on it; a bird is falling on the plant and an exclusive Dürer square symbol; behind the two men is a deer; behind Eve is a bull; on the top of a distant hill is a sheep; and at the bottom of the painting is a cat; at Adam's feet is a mouse. The painting shows Eve, looking natural and serene, with Adam and Eve in a curvy standing position^[10]. Instead of a traditional orchard, Dürer placed them in a Germanic wood, where the delicate effects of light and shadow on the beautifully modelled bodies were played out against the silky black background of the wood. Dürer's handling of this dense, layered and intricately lit scene is well balanced, and the painting shows a man and a woman in posture, in motion but momentarily at rest, despite the apparently naturalistic state, the distorted structure of the head and body is clearly artificial and sculptural, extending from the proportions of the facial features to the rest of the body, sacrificing the naturalism to demonstrate his mastery of the 'Vitruvian Man' concept, more like a showcase for Dürer's classical understanding of proportion. Dürer gives them a human face, expressing the humanism of the German Renaissance, which came to recognise the value of the human individual.

The pose and physique of the figures are carefully posed, and it is easy to see that they were heavily influenced by Italian and classical art. However, the man in the painting was measured repeatedly with a circular gauge and ruler according to theory due to the limited conditions, and under the influence of Leonardo, who put attention to anthropometry. After being influenced by Italian art, he was more obsessed with anatomical accuracy and the internal logic of structural relationships than the various contour lines and more stereotypical nudes of his early painting style, and approached the painting process with a scientific attitude. By experimenting with various human proportions, he tried to find a definitive rule that embodied the idea of beauty and harmony. He was very concerned with research on anatomical issues and his reticulated lines follow the undulations of the structure, a technique paved with a wealth of anatomical knowledge.

4 Conclusion

Anatomists and artists go hand in hand, because understanding human anatomy is essential to creating realistic and accurate body art. From the ancient Greeks dissecting cadavers to understand the human form, to Renaissance masters creating highly realistic models of the human body, artists have studied human representation in art for centuries. Artists have used their knowledge of anatomy to create different ways of expressing themselves. With a greater understanding of anatomy, artists have been able to use their skills more effectively to communicate their ideas and opinions. Understanding anatomy gives artists an effective tool for expressing their thoughts and feelings through art. This allows them to create more powerful and expressive works of art that appeal to their target audience. From highly realistic depictions of the human body in classical art to more abstract, powerful representations, the study of anatomy has influenced art in many ways. Leonardo da Vinci, Michelangelo and Dürer were not only able to create their own creations in painting, but they also pushed the art of the Renaissance forward. They broke away from the negative influences of the Gothic period, perfecting their realistic techniques, creating masterpieces of Renaissance art and taking the use of the human scale to a new dimension.

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