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RESEARCH PAPER

Analytical Study of Perspective Techniques in Leonardo da Vinci's Paintings

Ahmed Faraz

Assistant Professor, Visual Communication and Design, University of Home Economics, Lahore, Punjab, Pakistan

Corresponding Author | ahmedfarazgull@gmail.com

ABSTRACT

The western Renaissance is a revolutionary phase with respect to artistic methods. The art of Italian Renaissance artist Leonardo da Vinci shows scientific use of the compositional elements. His contributions of perspective theories reflect a connection between the fields of art and science. This research examines Leonardo's use of perspective in the paintings, which is an everlasting influence on art and science till the present time. In *A Treatise on Painting*, Leonardo documents the feature of human vision which is capable to perceive the spatial depth. He presents linear perspective and atmospheric perspective as vital devices for creating an effect of depth in the painting. In addition, the techniques of sfumato and chiaroscuro give his paintings a realistic appeal. The article offers demonstration of linear perspective through diagrams laid over the images of Leonardo's paintings. Further, it analyzes the paintings formally to study perspective in relation to the subject painted. The emphasis is laid on the balance and harmony achieved through the use of perspective techniques.

KEYWORDS Atmospheric Perspective, Chiaroscuro, Italian Renaissance, Leonardo da Vinci, Linear Perspective, Sfumato

Introduction

Renaissance, which means rebirth of classical art, approximately dates from fourteenth to early seventeenth centuries. It is considered to be one of the most influential eras in art history, because of the revival of classical elements and innovation of new methods. During this era, the art of painting gained a great progress due to the introduction of depth and perspective. The methods adopted to represent depth and space are responsible for the aesthetic appeal and illusion of third dimension on two-dimensional surface. Italian artist Leonardo da Vinci pioneered the techniques of perspective both practically and theoretically. Practical demonstration is seen in the paintings, while for theoretical explanation he wrote *A Treatise on Painting* (1651). These perspective techniques aid in realistic portrayal of the world with accurate space and depth representations. These innovative methods continue to develop artist's perception regarding space and narrative till the present day.

The elements that help in establishing perspective in Leonardo's paintings include two fundamentals, which are architectural lines and tonal gradation. The diagonal lines of architectural elements like walls, columns, balustrade, and verandas are carefully arranged to meet at a point on the horizon. These lines are usually drawn from the edges of objects to the vanishing point where these lines appear to converge, and help to define the recession of the space. The diagonal lines of these structures direct viewer's attention to the center of the painting, and is known as linear perspective. It is one of the most important developments in Western art which was refined and popularized during the Renaissance.

Linear perspective makes use of mathematical principles to create an illusion of depth and three-dimensional space on a two-dimensional surface. This type of perspective permits artists to precisely portray the comparative sizes and distances of objects within a composition. Leonardo's use of geometry and mathematics is observed in preliminary sketches showing grids and compositional lines, which highlights the importance of proportional accuracy for him. Additionally, Leonardo's paintings display the use of golden ratio to create balanced compositions.

The other tactic adopted by Leonardo for illusion of depth is the tonal gradation, for which sfumato technique is used. It is the process of gradually blending colors and tones to create soft rendering. Leonardo softened the transition between light and shadow to create an atmospheric perspective that gives life to the subject against the toned-down background. The depth created in the painting through the differentiation of colors creates atmospheric perspective. The objects in the distance appear less detailed, lack sharpness, and lighter and cooler in color tone due to the atmospheric effects like mist, air and natural light. Leonardo masterfully incorporated atmospheric perspective in his paintings to subtly transform the colors towards the background. The material used for painting, including the oil paints, oils of varying density and various types of brushes, permitted the desired effect according to the atmospheric condition.

These perspective techniques were revolutionized and popularized by Leonardo. Not only did his work advance the technical side of art, but it also revolutionized the way that space and volume were depicted on canvas. The linear and atmospheric perspective play an important role in defining the visual vocabulary of Renaissance art, and help to create realistic representations of space and scale in painting. This article presents some notable examples of Leonardo's paintings using different types of perspective techniques. Before proceeding to analyze the paintings, a brief review of literature is included in the research.

Literature Review

The available literature relevant to the use of perspective in Leonardo da Vinci's paintings provide beneficial knowledge. However, there are some gaps identified in the literature. The review provided by this research mentions those gaps and aims to contribute in the field of research by presenting the significant knowledge for the understanding of perspective through da Vinci's paintings.

Leonardo da Vinci (1651) himself elaborates different perspective techniques that he has employed in his paintings. In his treatise, he discusses in detail the linear perspective and how the objects appear reduced in size in the distance, and how a certain object is drawn in accurate size with respect to the proportions of other objects in the composition. He further emphasizes on atmospheric perspective, and the color and light differences in the close and distant objects, as well as the effect of air on our eye that makes us differentiate between the distances. Leonardo's *Trattato degli pittura* (*A Treatise on Painting*) leads the research towards a deeper analysis of his paintings.

Pirenne (1952) discusses the innovative perspective theory with regards to the paintings of da Vinci. He studies da Vinci's contribution towards perspective in his paintings, emphasizing his in-depth optical and geometrical comprehension of perspective. This article goes through a lot of detail to show that da Vinci's way of representing depth and three dimensions in his paintings was based on a deep understanding of science, which was a big step forward in art and laid the foundations for modern perspective techniques (p. 169-185).

Atalay (2011) examines the relationship between art and science in Leonardo da Vinci's painting *Mona Lisa*. It examines how his knowledge of mathematics and science shaped his artwork, and how his scientific and mathematical accuracy contributed to the enduring fascination and mystery of his work.

The existing literature lacks clear demonstration of perspective through images. However, this article presents the study of perspective in da Vinci's painting through drawings overlaid on the images of paintings, hence providing a comprehensive understanding of the subject.

Material and Methods

The research has been executed in American Psychological Association (APA) format. The data has been collected from various online sources including data bases, encyclopedias, magazines, and articles. The analysis of the perspective in the paintings is done according to qualitative method. For the justification of various perspective theories, line drawings have been created using the software of Photoshop.

Results and Discussion

The *Annunciation* is one of the most famous paintings of the Italian Renaissance (fig. 1). It was painted by Leonardo between 1472 to 1475 (Parenti D., n.d., para 1). In this painting, Leonardo has used the techniques of linear and atmospheric perspective to create depth and space within the composition. Architectural elements, such as columns and arcades, use one-point perspective to guide the viewer's gaze towards the rear of the scene. This linear perspective is applied to the architecture and the positioning of figures. The architecture recedes into the background using converging lines and the figures of angel Gabriel and Virgin Mary are placed in a way that conveys depth and space. While the vanishing point at which the lines converge may not be immediately apparent, the overall effect is spatial depth. Landscape in the background uses atmospheric perspective to gradually lighten and lose detail as they recede into the background. In *Annunciation*, the use of perspective, as well as attention to details and naturalistic drawing of forms, helps create a realistic and harmonious image.

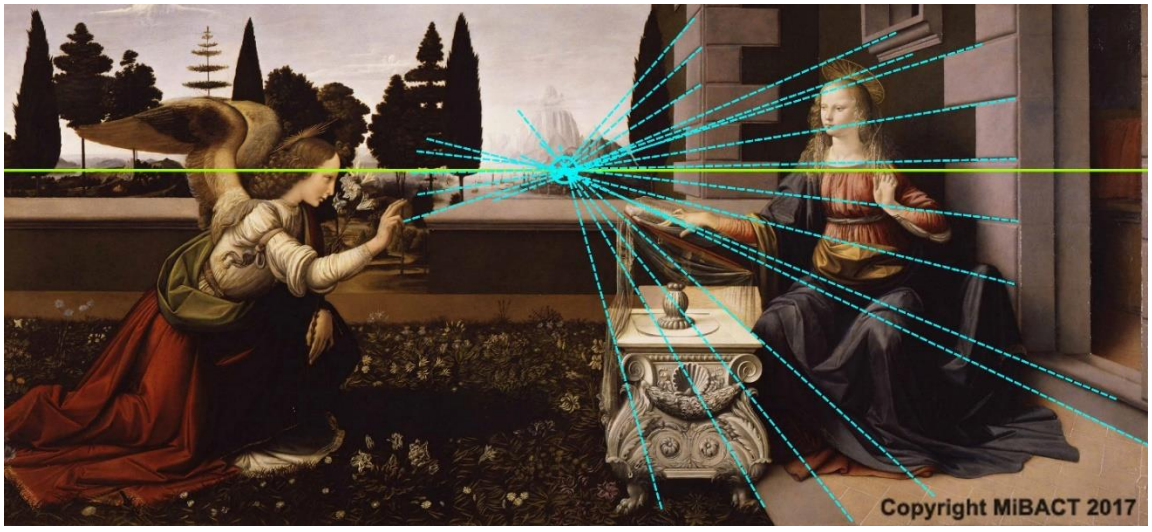

Figure 1. Leonardo da Vinci, *Annunciation*, c. 1472-1476, oil and tempera on poplar panel, 98 x 217 cm, Uffizi, Florence.

The *Ginevro de' Benci* (c. 1474-1478) is considered to be one of the most influential works of art in the history of the world (fig. 2). It represents the power of composition and the principles of aesthetics. Annunciation is also presenting the value of pride and reticence through its visual representation. Sfumato and Chiaroscuro techniques are used to study the light to dark transition and combination of landscape and portrait in creation of this masterpiece. There is clear depiction of culture and history of Italy during the 15th Century.

Just like other paintings of Leonardo, in *Ginevro de' Benci*, he studied the perspective in detail. Landscape which is used in the background represents the atmospheric perspective but on the other hand the figure is placed in such pretty manners to convey the depth. Annunciation is considered to be the very initial example of the work by Leonardo's in which he used perspective technique. Portrait of a very young Italian women (Ailsa Mellon Bruce Fund, 2023, para. 1-4) has been depicted in this painting. Leonardo da Vinci's meticulous use of perspective techniques is an early example of his mastery of depth and realistic approach.

Leonardo uses curvatures and lines to show the distance between different points. Innumerable marks are used to separate different objects in the painting. Such marks have created a three-dimensional effect in the painting. Leonardo uses different kind of grounds in the Painting including the foreground, the middle ground, and the background. He uses hue and intensity to create three-dimensional effect. He uses black and white to add value to different colors to create atmospheric effect. The use of space is evident in *Ginevra de' Benci*.

He has used texturing and patterning to create a powerful meaning in the painting. This masterpiece has various textures. For instance, the woman's face appears smooth, while the hair has a tactile quality. The principles of art are very strong in Leonardo's paintings, as evident in the idea of unity. All the parts of the painting come together to form a single image. Leonardo uses different elements to create diversity, ultimately achieving balance. The mountains and trees are in harmony with each other. The parts of the painting have been arranged in a consistent way. Through all the elements, the viewer is directed to concentrate on the face of *Ginevro de' Benci*. The woman's image makes this masterpiece significant to the viewer.

Figure 2. Leonardo da Vinci, *Ginevra de' Benci,* c. 1474-1478, oil on panel, 38.1 x 37 cm, National Gallery of Art, Washington, D.C.

The Madonna of the Carnation uses the perspective techniques in an innovative way (fig. 3). More specifically, it uses the mathematical system of linear perspective. The Madonna and the Child are seated against a backdrop of round arches opening up to a mountainous landscape. The pyramidical composition is formed by the figures. The upper point of this pyramid also acts as a vanishing point which lies in the atmospheric haze of the landscape. Leonardo's use of both the perspectives contributes to the realistic rendering and spatial accuracy of the painting.

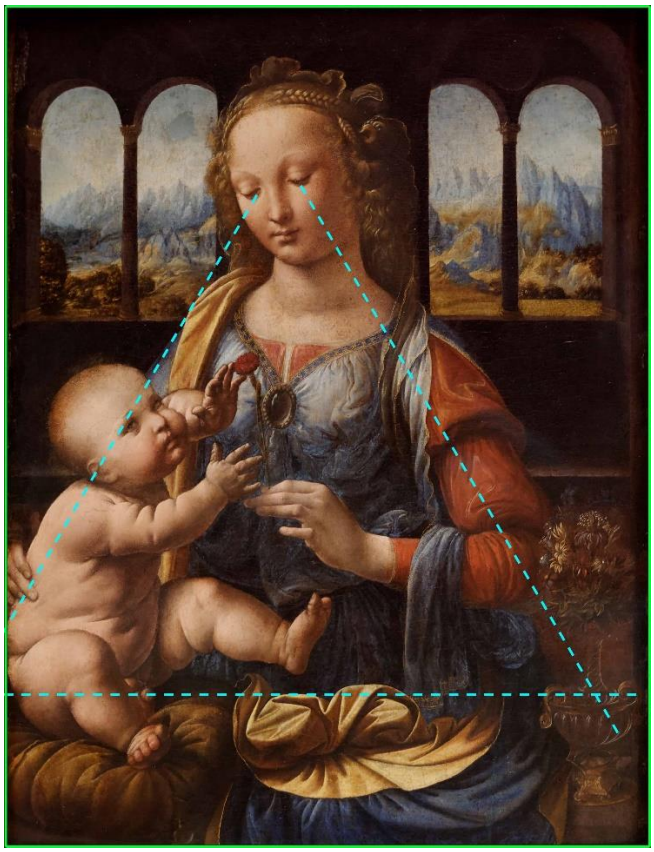

Figure 3. Leonardo da Vinci, *The Madonna of the Carnation,* c. 1478-1480, oil on panel, 62 x 47.5 cm, Alte Pinakothek, Munich.

Adoration of the Magi is an unfinished work by Leonardo which is an example of his experimental approach to composition and perspective (fig. 4). Leonardo combines linear perspective with architectural elements to create depth and spatial organization in the composition. The painting is composed of a complex combination of figures, architecture and landscape. Architectural elements and surrounding elements, like the walls and cityscape, in the background are organized according to linear perspective principles. Leonardo used converging lines to draw the viewer's eye into the distance.

As the buildings and walls recede from the background, their sizes and details diminish, creating the illusion that the space is receding. Although the atmospheric perspective is not very deep, there are hints of the artist's interest in depth through subtle color and tonal changes (fig. 7). In the unfinished parts of the painting, the far-off landscape and figures become less detailed and take on a slightly blueish hue, which hints at the atmospheric implications of distance.

The illusion of depth is also created by the overlapping figures. All the figures in the painting face towards the figures of Virgin Mary and the Child, creating a compositional unity. The figures are arranged against the architecture in such a way that

the viewer's eye is drawn to the central figures. Although the painting is incomplete, it still provides insight into how Leonardo was experimenting with perspective and composition during this period. Due to its unfinished state, some of Leonardo's techniques may not be fully realized. The painting shows the continuing explorations of deepness, wisdom, three-dimensional and spatial representation by the Leonardo along with the innovative approach of use of perspective even in its incomplete state.

Leonardo was committed to faithfully portraying the natural world. His meticulous observation of the natural environment and human anatomy can be seen in the realistic representation of the faces and expressions of the characters. He was an early pioneer in the study of light and its influence on the form of objects. The use of natural light was one of Leonardo's greatest skills.

In *Adoration of the Magi*, he used natural light sources like the star in the heavens and the torches that some of the figures held in their hands to create a dynamic combination of light and shadow that adds drama and meaning to the scene. This painting is an example of his innovative techniques, meticulous methods, and deep knowledge of light. The use of sfumato and chiaroscuro, as well as layering, and his desire to capture the natural world, all contribute to its timeless appeal and artistic value. Though incomplete, there is an aesthetic appeal in the painting due to the proficient use of compositional elements.

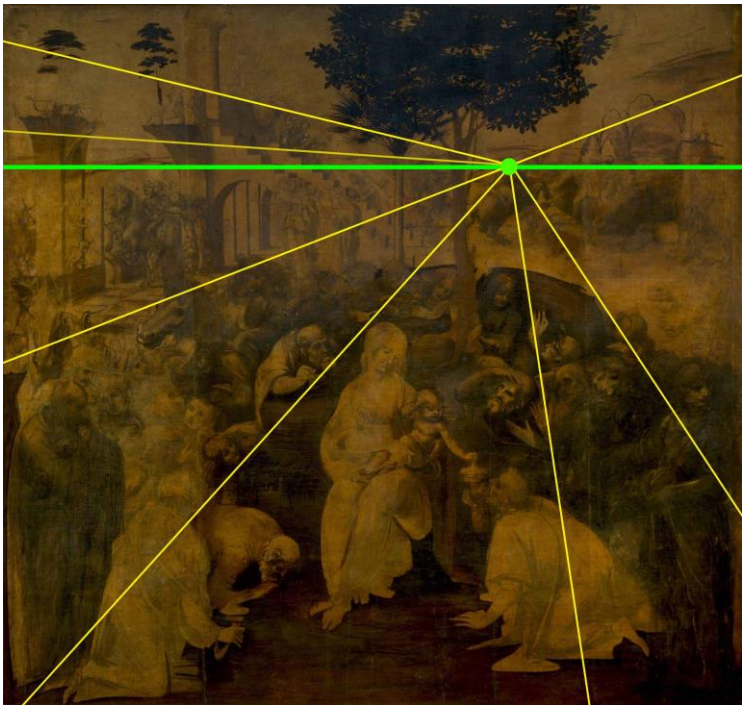

Figure 4. Leonardo da Vinci, *Adoration of the Magi*, c. 1481, oil on panel, 244 x 240 cm, Uffizi Gallery, Florence, Italy.

Leonardo da Vinci's *The Virgin of the Rocks* (c.1483-1486) is a painting that exists in two versions (fig. 5). The Louvre Museum, Paris, has the Louvre version of the painting, while the National Gallery, London, has the London version of the painting (Vertue, 2021, para. 1-4). Both versions use the sfumato technique for atmospheric depth. He has created the illusion of objects within the painting, emerging from or receding into a foggy, smokey background.

In addition to his use of sfumato, Leonardo also employed linear perspective to create an illusion of third dimension in the composition. Examples of this can be seen in the positioning of rocks, the gradual descent of the landscape, and the positioning of figures within the composition. Both linear perspective and sfumato serve as two of the most innovative approaches to perspective in art employed by Leonardo.

Another noticeable compositional device used in this painting is the golden ratio, which is considered as Divine proportion. It adds aesthetic appeal in the composition by creating balance among various elements. This ratio consists of a rectangle divided into golden sections, which all together form a spiral form (Nico Franz, 2023, para. 54-68). Leonardo's has placed the main elements of this painting along this golden spiral, emphasizing the focal points for a harmonious composition. The focus is laid on the figures of Virgin Mary and the infant Christ, upon whom the other two figures are pointing with fingers.

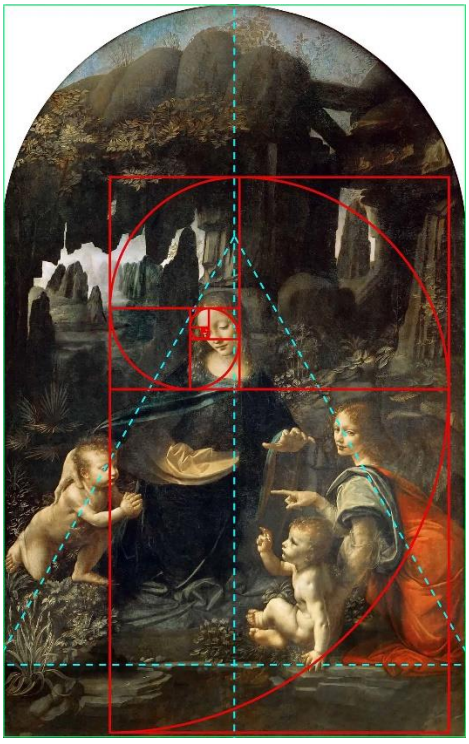

Figure 5. Leonardo da Vinci, *The Virgin of the Rocks*, c.1483-1486, oil on panel, 199 x 122 cm, Louvre, Paris.

The Last Supper (c. 1495-1498) is one of the most famous and studied artworks of all time (fig. 6). The perspective used in this remarkable mural is essential for conveying the depth and narrative importance of the scene. The composition is centered around the table where Jesus and his followers are sitting. The architecture lines and the ceiling converge at a single point behind Jesus, guiding the viewer's gaze to the focal point. Careful attention to perspective allows the viewers to immerse themselves in the dramatic scene of Christ's last supper with his Apostles. The painting's perspective is primarily achieved by a combination of linear technique and atmospheric technique. Linear perspective is observed in the architectural lines vanishing in the center of the painting at the Christ's head, drawing the viewer's attention towards him as the center of attention. But it is the combination of atmospheric perspective with the linear perspective that takes *The Last Supper* to the next level.

Leonardo's mastery of light and shadow as well as the slow fading of colors adds a sense of the distance and atmosphere to the scene. The Apostles closest to the Christ are shown in sharp detail and rich colors, while those further away gradually fade in intensity, which reflects the natural movement of light in our environment. Not only does this technique add an illusion of depth, but it symbolically emphasizes the relative importance of the figures and the upcoming events. Besides the technical aspects of the perspective, it allows viewers to immerse themselves in the complex interactions between the Apostles. Each figure's posture, expression and interaction with others becomes more real and relatable through the immersive perspective.

The Last Supper is a masterpiece of Leonardo's use of perspective. To bring the observer into the midpoint of the section, he integrates the atmospheric and linear perspective and make them an active member in the section of the actual story. *The Last Supper* surpasses the historic as well as arty framework, and remains an enduring illustration of how perspective can be achieved in pictorial story.

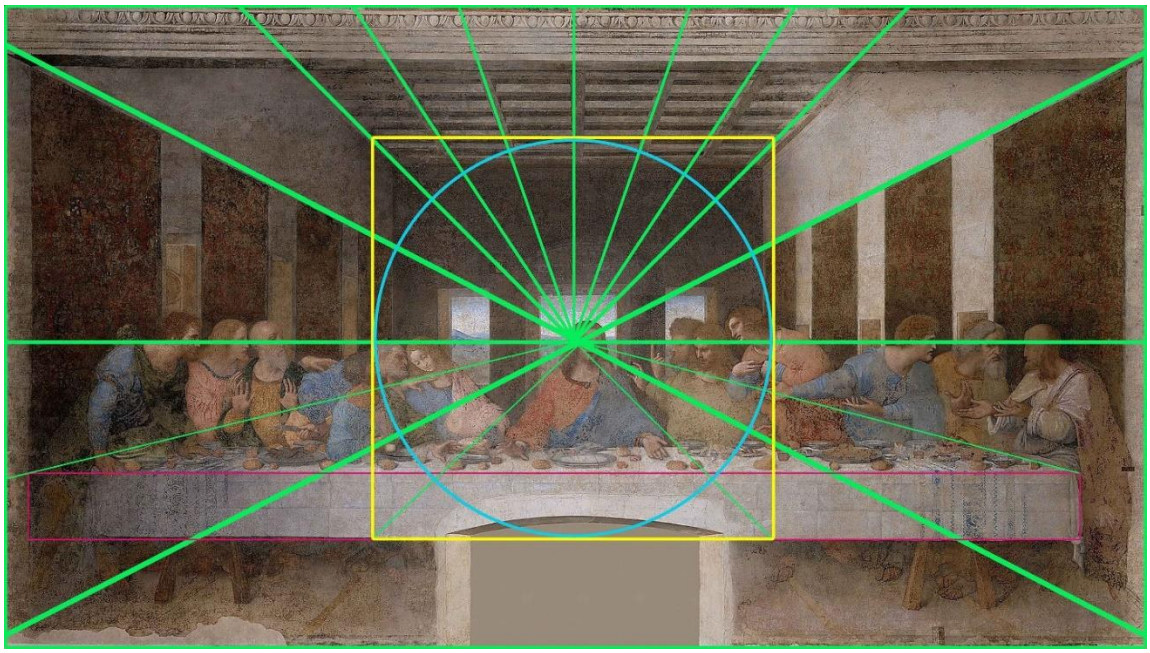

Figure 6. Leonardo da Vinci, *The Last Supper*, c. 1495-98, tempera on wood, 104 x 69 cm, Tretyakov Gallery, Moscow.

Leonardo's *Mona Lisa* (c. 1503-1506) is one of the world most renowned and timeless painting that attracts the viewers till today (fig. 7). The aspect that distinguishes this painting from his other paintings is mastery in the depiction of perspective. The sense of depth in the background landscape is achieved through the atmospheric perspective. The land recedes in the distance by the means of colors that gradually turn from warmer in the foreground to cooler in the background. The far-off mountains are toned down and lack details and vibrance as compared to the foreground, creating the effect of atmospheric haze. Sfumato technique used for blending the tones adds depth in the painting.

The atmospheric effect created in this painting points towards science as part of human perception. The portrait of the lady named Lisa Gherardini is painted in three-quarter view against the backdrop of a vast landscape. The haze of the mountains and valleys makes the portrait even more prominent. In addition. Linear perspective is observed in the diminishing sizes of the mountains and the balustrade, adding spatial aspect to the painting. The main figure, however, shows detailed anatomical and textural

study. Light and shadow in the face are handled with the masterful use of sfumato technique. The techniques employed in the painting display Leonardo's expertise in creating an atmosphere of charm and mystery.

The balance in the painting is created by the composition of elements around the golden spiral which begins from the center of the face and surrounds the head to reach the hands. This spiral adds dynamic approach to the painting, which is also enhanced by chiaroscuro. The incorporation of all the compositional devices including linear and atmospheric perspective and golden ratio, makes the *Mona Lisa* seem real and mysterious at the same time, establishing the painting as a masterpiece of Renaissance art.

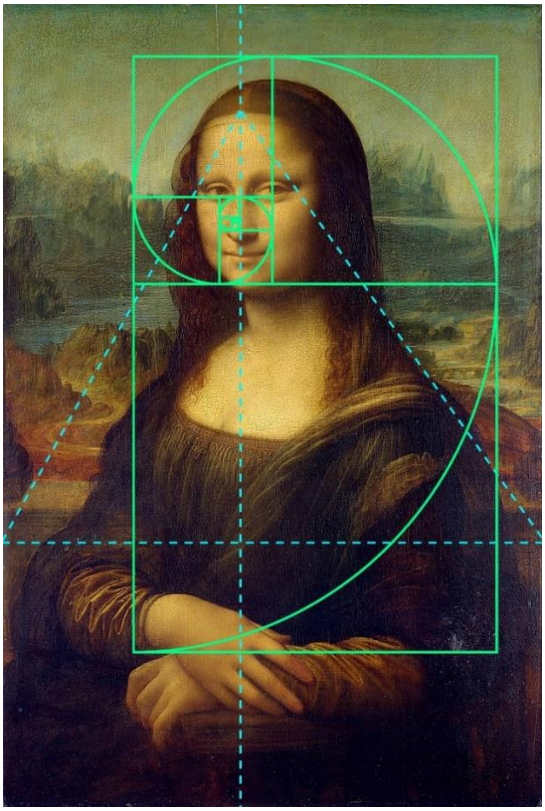

Figure 7. Leonardo da Vinci, *Portrait of Lisa Gherardini* (known as the *Mona Lisa*), c. 1503-1506, oil on poplar panel, 77 x 53 cm, Louvre, Paris.

To draw the attention of the viewer in the painting of *Saint John the Baptist* (c. 1513 to 1516), Leonardo used chiaroscuro technique. *Saint John* is reflected as a very young man who is carrying red cross with a mysterious look. In the dusk of background his camel's hair are inundated in the darkness of the background. To achieve this compositional wisdom in the painting he uses atmospheric perspective. This atmospheric principle makes the portrait of Saint John to viewpoint. Use of chiaroscuro technique adds a third dimension to it along with the illusion of deepness through the light that reflects on the body's curves that creates contours.

Leonardo adds the spatial and volume by close study of the human form in order to anatomical proportion that helps to reflects the realistic representation of *Saint John the Baptist.* In addition to this, modeling around the golden ratio adds more volume and presence of three-dimensional impact to the figure, though the background is relatively too small which shows more basic and simplified version in order to understand the

perspective. The painting of *Saint John the Baptist* does not reflect the intricate panoramic interpretation of the scenery that considered many of his early and later pieces. Instead, its quintessence on the main character, charisma and his contemplation.

Leonardo' uses soft, subtle light to bring a sense of soft sparkle and tranquility into the composition of *Saint John the Baptist*. The mysterious smile expressions of the Baptist are illumined by the soft light. These expressions are the main signature feature of many Leonardo's paintings. The use of sfumato, chiaroscuro and a profound understanding of light under the translucent glazes, create a realistic, soft transition between the light and dark parts of the painting. The delicate balance of light and shadows, combined with Leonardo's attention to anatomical details, is what makes this painting enduring and significant.

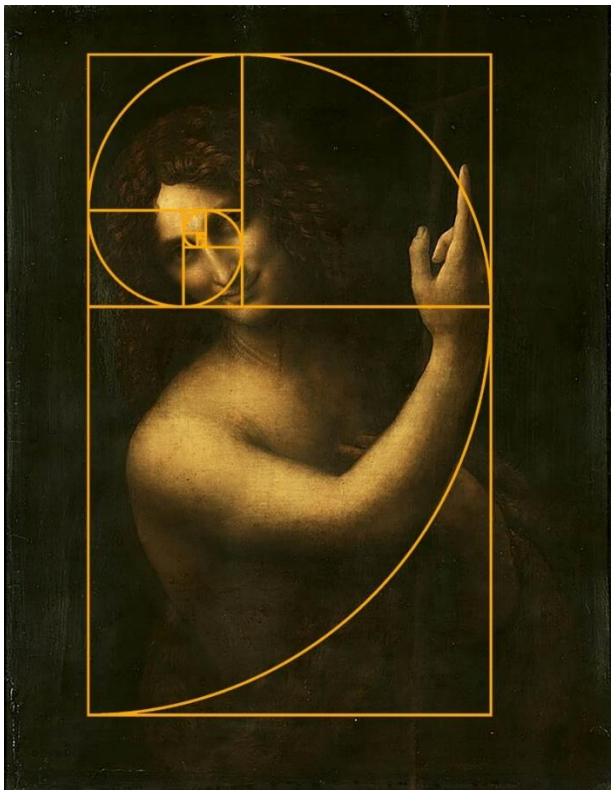

Figure 8. Leonardo da Vinci, *Saint John the Baptist*, c. 1513-1516, oil on walnut wood, 69 x 57 cm, Louvre Abu Dhabi, Abu Dhabi.

The Virgin and Child with Saint Anne (1499-1500) is a highly detailed composition (fig. 9). The intricate arrangement of figures in the golden ratio and the detailed background landscape illustrates Leonardo's ability to create depth through mastery of proportion and perspective. The atmospheric perspective is used which makes the figures and landscape look as if they are part of a unified three-dimensional space. The background of the painting, with its far-off mountains and landscape features, is painted with a gentle, mist-like haze. The tones of the colors are muted and cooled, adding depth and distance to the painting. The characters in the foreground of the painting, including the Virgin and the Child with a lamb, are brightly colored and exquisitely detailed, and stand out against the backdrop of the distant mountains.

Pyramid composition has been used in the painting of *The Virgin and Child with Saint Anne* in which St. Anna is at the top, Virgin Mary in the middle, and then the Christ Child is at the bottom right who is holding a lamb. One noteworthy aspect is the figures

positioning. We will find the golden ratio if we draw rectangles and find the approximate proportions of these rectangles around the Saint Anne, Virgin Mary and the Christ. This pyramidical composition draw the viewer's devotion and attention to the main characters to create a sense of harmony, unity and balance within the painting. In this great way Leonardo's expertise in the field of art and science proves how he incorporated scientific principles into his work.

Furthermore, Golden Ratio and Fibonacci spirals is achieved through the drapery in which spiral patterns can easily be identified. Through these spirals visual harmony and balance is achieved within the painting by Leonardo. It's also significant to note that use of Golden Ratio is not always intentional in art, art historians identify the presence of Golden Ration in this painting by analyzing the three-dimensional relationship and proportions within the composition and alignment of *The Virgin and Child with Saint Anne.*

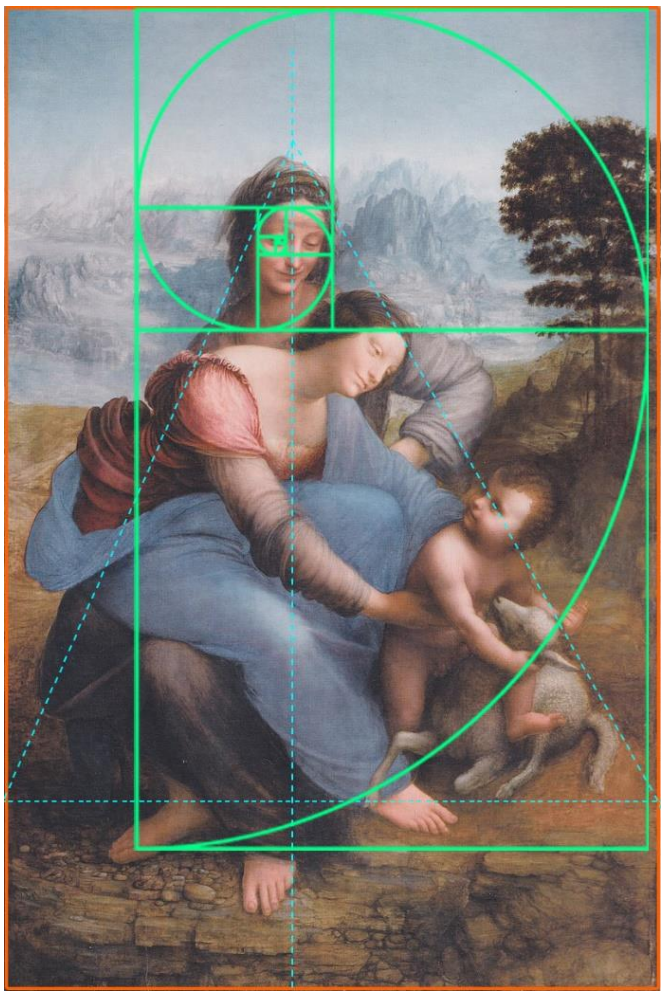

Figure 9. Leonardo da Vinci, *The Virgin and Child with St. Anne*, c. 1510, oil on wood, 168 x 130 cm, Musée du Louvre, Paris.

The analytical study of Leonardo paintings demonstrates the significance of perspective techniques in creating depth and spatial effect in the compositions. His masterful use of both linear and atmospheric perspective imparts a great influence on the art of painting throughout the world, establishing him as one of the most prominent artists of all times. This research develops an understanding of perspective techniques for the learners of art. Leonardo's contribution in art also have a vital role in scientific advancements in vision and optics.

Conclusion

The perspective theories presented by Leonardo da Vinci in *A Treatise on Painting* are visually demonstrated by him in the paintings. The use of perspective techniques for the illusion of depth in the painting marks Leonardo's significant contribution towards the field of art and science. Further explanations of the techniques of perspective are presented in this paper, which focuses on the linear and atmospheric perspective used by Leonardo. The article provides evidence of linear perspective through the use of linear diagrams laid over the images of paintings, showing the receding lines towards the vanishing point. While atmospheric perspective is studied through the observation of tonal gradation for which sfumato and chiaroscuro techniques play a vital role.

The study of the interdisciplinary methods of creating depth on a two-dimensional surface shows the connection between art and science. Leonardo's innovative methods not only bridge the two different fields, but also defy the boundaries around them. The study of perspective besides providing an understanding of Leonardo's paintings, also highlights the importance of this technique in painting, regardless of the timeframe.

The depth in the paintings, achieved through linear and atmospheric perspective, add realistic appeal to the paintings, making the visual more relevant to the actual world. The research comprehends the feature of human vision and its ability to perceive the distance through the two-dimensional visual. For this understanding, Leonardo is highly creditable and serve as an inspiration for the later artists. His contribution holds a great worth for both art and science.

References

Ailsa Mellon Bruce Fund. (2023). *Leonardo da Vinci: Ginevra de' Benci [obverse], c. 1474/1478*. National Gallery of Art.

Anirudh. (September, 2016). *10 Most Famous Paintings by Leonardo Da Vinci*. Learnodo Newtonic.

Atalay, B. (2011). *Math and the Mona Lisa: The Art and Science of Leonardo da Vinci*. New York: Smithsonian Institution.

Franz, N. (2023). *Virgin of the Rocks*. Nico Franz.

Gurney, T. (n.d.). *Saint John the Baptist*. The History of Art.

Joy of Museums Virtual Tours. (2023). *"Madonna of the Carnation" by Leonardo da Vinci*. Joy of Museums Virtual Tours.

LeonardodaVinci.net. (n.d.). *The Virgin and Child with St Anne by Leonardo da Vinci*. LeonardodaVinci.net.

Parenti D. (n.d.). *Annunciation*. Le Gallerie Degli Uffizi.

Pirenne, M. H. (1952). The Scientific Basis of Leonardo da Vinci's Theory of Perspective. *The British Journal for the Philosophy of Science*, *3*(10), 169-185.

Vertue K. (2021). *A Double Virgin of the Rocks*. Medium.

Vinci, L. D. (1802). *A Treatise on Painting*. (J. S. Hawkins, Trans.) Kiribati: J. Taylor (Original work published in 1651).

Virtual Uffizi Gallery. (2023). *Uffizi tickets for the Uffizi Gallery, Florence ticket reservations*. New Globus Viaggi.

Zelazko, A. (2023). *Last Supper: Painting by Leonardo da Vinci*. Encyclopedia Britannica.

Zucker S. & Harris B. (n.d.). *Mona Lisa*. Khan Academy.