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Disturbing the Perspective: The Church against the New Perspective of Galileo and Cigoli

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Resumo: O presente trabalho avalia a questão da perspectiva na obra galileana e seu impacto na nova arte da perspectiva no renascimento e as tensas relações com a Igreja Católica.
Palavras-chaves: Perspectiva, Galileo, Cigoli, relação ciência-arte.

Abstract: The perspective issue in the work of Galileo, its impact on the new art of perspectives in the Renaissance and the tense relationships with the Catholic Church are evaluated.
Key words: Perspective; Galileo Galilei; Science-Art relationships.

> Past products of artistic activity are still part and parcel of the artistic scene. [...] In Science, new things start with the abolishment of books and scientific journals, now turned obsolete, and the elimination of their active stance in a Science Library, removed to a barn [...] In contrast to Art, Science destroys its own past. (KUHN, 1993, p. 370)

I. DA VINCI'S MOON

The relationship between Leonardo da Vinci and the artists that succeeded him, which involve the interrelationship between Science and Art, which, on its part, is still to be understood, requires a survey on a very important theme: the tangibility of the Moon by Science and by Art, as a dense, corruptible and anti-Aristotelian body, welded to the four sub-lunar elements.

Believing that a work of art should express total reality, Leonardo da Vinci was one of the most important scientists who worked on the boundary between Art and Science. In da Vinci's opinion, it was necessary to limit the represented thing, the image, to its own essence so that one could see further on:

> [...] in his opinion, the essential thing is the concrete and the immediate, the circumstantial and the possible [...] Space, nature, perspective systematic analysis, sheer objectivity, the value of experience, the "scientific" eye and the primordial hiddenness of things strengthen his art through "hermetic totalities". Through such attitudes, da Vinci discovers [...] the soul's passion for the

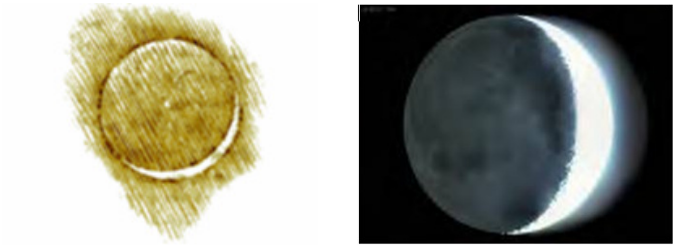
> boundaries of knowledge in his transportation to the threshold of beauty (PRIETO & TELLO, 2007, p. 7)

"Primordial hiddenness" is da Vinci's motif to direct himself towards the natural comprehension of physical objects. Such behavior is not common for a man of the Renaissance, still in its birth pangs and blurred by the Aristotelian-Thomist architecture that poisoned all and every world vision.

In da Vinci's writings, extant in the Leicester Codex and comprising his works on nature, weight and water movements, curious notes on and sketches of the Moon, coupled to its light and its nature, are given. Leonardo states that "*della luna – nessun denso è più lieve che l'aria*".

Leonardo triggers an argument that will lead him to the outskirts of Galileo's thought. When he studies the *lumen cinereum* phenomenon, taking precedence on Galileo by a century, da Vinci explains that the luminous phenomenon is produced by the reflections of the seas, similarly to what occurs with terrestrial seas and not by some intrinsic and autonomous phenomenon of the lunar light (Figure 1). Da Vinci's intuition perceives an irregular light, non-homogeneous to the moon's outlines, that separates the light section from the dark one (in the first and last quarters)

Figure 1 - The *lumen cinereum* phenomenon



Leonardo's doubt on the moon's nature "is whether the moon is a ponderous or light body". He even affirms, dangerously for an Inquisitorial age, that the Moon may have an atmosphere similar to that of the Earth's, in which physical laws must be the same as for sublunar elements. "The Moon has water, air and fire and sustains itself in space similar to the Earth, with its elements in another space. Thus dense things do the same things as the Earth's dense things do" (VINCI, 1996, p.46).

An interesting astronomic observation is reported in Letter 7B under the title "Della Luna". When Leonardo studies once more the issue of lunar luminosity, he reaches the conclusion that its surface must be wrinkled:

> Since the Moon does not have its own light, its luminosity must be caused by other things, (...) the pyramidal light is stored, whose pyramid is based on the sun; the sun and its angle end up in the center of the Moon [...] The Moon's surface is wrinkled and its rugosity does not occur unless by liquid bodies moved by the wind, as we see the Sun is mirrored in the sea by means of a few waves (...) It should thus be concluded that the Moon's luminous section is made up of water [...] (VINCI, 1996, p. 28)

Da Vinci's technique, which precedes the perspective already started by Giotto, Masaccio and Alberti, is foregrounded in an atmospheric perspective or *sfumato*. Leonardo gives an effect of distance and breaks off the canvas's bi-dimensional space by a three-dimensional effect which was practically non-existent in the old-fashioned aggregate space (PANOFSKY, 1927) of the Middle Ages. In the latter case, objects are juxtaposed on the canvass's bi-dimensional space without taking into consideration spatial relationships.

Leonardo was always interested with the perspective issue which, in its bi-dimensionality, represented the feeling of depth and space. He therefore sought to understand the function of the eyes: "Extending the outlines of each body, in proportion to their convergence, we will bring them to a single point and the above-mentioned lines necessarily form a pyramid" (VINCI, 2004, p. 107).

Da Vinci classified painting as a science that triggered the study on perspectives or the science of visual rays. Science would thus be subdivided into three perspectives: linear, color and blurring:

> [...] the first deals with the reason of the (apparent) diminishing of objects when they are distant from the eyes. This process is known as the diminishing perspective; the second contains the manner colors vary when they are distant from the eyes; the third and last explains how objects should appear proportionately less distant in so far as they are more faraway (VINCI, 2004, p. 107).

With regard to perspective, da Vinci explained:

> Perspective is nothing more than seeing a place behind a plain and transparent glass on whose surface all objects behind the glass may be marked (VINCI, 2004, p. 108).

Leonardo gave practical examples, such as that of furrows in a field ("points of flight"), so that one could understand perspective: "Only on one line, out of all that reach the visual power, intersection occurs. It does not have any palpable dimension since it is a mathematical straight line which originates itself from a mathematical point with no dimension" (VINCI, 2004, p. 110).

In his "Tract on Painting", Alberti had already explained the fundamentals of perspective (ALBERTI, 1966). The law of perspectives, or rather, an image representation that simulated a three-dimensional space on a bi-dimensional surface, was already known during the Italian 15th century. Light and shadows could be modeled with the impression of three-dimensionality. The *aggregate space* of the Middle Ages definitely gave way to the *space system* or the da Vinci *rilievo* (HOHENSTATT, 2000).

This is where the Moon's description as a wrinkled body lies – the Moon as a spreader of light reflected from the Earth, with the anti-Aristotelian stance of being a bed-fellow with the geocentric Earth, according to the rules of that time. One hundred years had to elapse for the invention of the "perspective tube" or *perspicillum* (GALILEI, 1987) by Dutch artisans and its posterior perfecting by the scientific genius of Galileo Galilei.

II. GALILEO GALILEI'S MOON

Galileo Galilei, born on the 15th or on the 19th February 1564, the latter date according to Vincenzo Viviani, his disciples and biographer (BREDEKAMP, 2000), a day after Michelangelo's death, would re-invent the new post-Copernicus science from an improvement of lens spectacles invented by Dutch artisans and sold as toys by the glassmakers of Murano and Venice.

Galileo perceived that by means of the "perspective tube" (Figure 2) he would analyze with more details the limits of vision while placing it at the reach of the "visual pyramid" that reveals more detailed information of the heavenly bodies.

Figure 2 – Galileo's telescope.

Without almost no knowledge on the basic principles of refraction, especially those by Grosseteste (1175-1253), Bacon (1214-1294), Digges (154?-1595), della Porta (1535-1615) and Kepler (1571-1630), Galileo (1564-1642) discovered the imperfection of the Earth that covered a universe mistakenly centered around a non-fixed Earth.

Feyerabend states:

> [...] serious doubts [exist] as to Galileo's knowledge of those parts of contemporary optics which were relevant for the understanding of telescopic phenomena. [...] Jean Tarde, who in 1614 asked Galileo about the construction of telescopes of pre-assigned magnitude, reports in his diary that Galileo regarded the matter as a difficult one, that he had found Kepler's *Optics* of 1611 so obscure 'that perhaps its own author had not understood it'. In a letter to Liceti, written two years before his death, Galileo remarks that as far as he was concerned the nature of light was still in darkness. [...] we must admit that his knowledge of optics was inferior by far to that of Kepler. (FEYERABEND*, Against Method*, cit. by ÉVORA, 1988, p.41).

In his workshop Galileo made improvements in the construction of telescopes which up till then were full of spherical and chromatic aberrations and directed the instrument to the heavens. He perceived the total implosion of the Aristotelic-Thomist world: a moon filled with craters, millions of stars, the satellites around Jupiter, spots on the Sun's moving disc and a strange configuration in Saturn.

In spite of his limitations in Optics, in 1610, when he published the *Sidereus Nuncius*, Galileo upthrusted the new physics that had already been revealed since the publication of Copernicus's *De Revoltionibus*.

With regard to the invention of an improved *perspicillum* Casati says:

> When Galileo points his telescope to the Moon, he sees it 'as if it distanced two mere terrestrial rays' […]. Galileo consequently reports that the Moon's surface is not contaminated by the great spots seen at all times and from all places, but also by other minor impurities that are visible within the boundaries between light and darkness and which arise, change their aspects and disappear with the growth and the diminishing of the Moon. [...] Galileo is not only an astronomer [...] but a master in sketches; in fact, he knows everything on shadows and the manner the shape of things is revealed by their mutations (CASATI, 2001, p. 163).

Galileo states

> *We have the same spectacle on Earth during dawn: we see the valleys still not illuminated and the mountains around them opposite the brilliant Sun. As the shadows of the earth cavities are made smaller in proportion to the rising of the Sun, these spots on the Moon lose the darkness in proportion to the growth of the luminous section. […] Not merely the limits between light and darkness on the Moon are shown unequal and curved but […] many brilliant apices are revealed on the Moon's dark section, […]which, after some time, increases in size and luminosity* (GALILEI *apud* CASATI, 2001, p.164)

Figure 3 – Sketches of the Moon in *Sidereus Nuncius*

Posterior to an analysis of the works of Ludovico Cardi, the Cigoli, the optical ignorance of Galileo seems to have been outweighted by his maturity as a man of art. Galileo attended the "Accademia del Disegno", in Florence, with lessons by the artist and engineer Buontalenti (BREDEKAMP, 2000). Around 1585, he acquainted himself with Cigoli with whom he shared his mathematical studies with Ricci. Such friendship would be highly important so that Galileo recovers the vision of the atmospheric perspective from the perspective tube (Figure 3). The *chiaro-oscuro* technique may be seen in its more mature and exceptional form. A new world, invisible to the naked eye, is revealed and the Aristotelian-Thomistic certitude of the perfection of the heavens and of the centrality and immovability of the Earth is imploded. It is important to state that when Galileo observed the projection of the solar disc, described in his *"Trattato sulle macchie Solari"*, he uses perspective to demonstrate that the Sun rotates around its own axis through his observation that the "deformations" of the spots go from the periphery to the center and backward. This only occurs when the spots are consonant to the Sun's moving surface.

III. LUDOVICO CARDI'S MOON

During the 1931 restorations on the dome of Santa Maria Maggiori, Rome, a later work comprising the erasure of an original picture of "The Assumption of the Virgin", by Ludovico Cardi, the Cigoli (1559-1613), was discovered (Figure 4). The fake part of the painting corresponded exactly to the Moon on which the Virgin was stepping. The original painting consisted of a Moon with craters exactly as that seen by Galileo in his *Sidereus Nuncius.*

Galileo and Cigoli were great friends as may be surmised by the latter's letter to M. Buonarroti (CARDI, 1912; MATTEOLI, 1964):

> *With great joy I appreciate your arrival among us, together with a bettering of our Mr Galileo and his miraculous arguments on celestial news, which I immediately transmitted to Mr. Giambattista Strozzi, who is very much pleased with the health of both..*
> [...]
> *If I may be of any service to you, will you please have the pleasure of asking.*
> *Rome, 8th January 1611.*
> [...],
> *Lodovico Cigoli*

Figure 4 - Cigoli; dome of Santa Maria Maggiore; "The Assumption of the Virgin", by Cigoli

Cigoli was an important painter and, in a special manner, a great theorist in perspectives. Significant references may be found in his *Trattato Pratico di Prospettiva.* Similar to da Vinci, he was interested in the formation of images by the eye, and he described them correctly (Figure 5), as if in a dark chamber.

Figure 5 – Cigoli's *Trattato Pratico di Prospettiva*

Cigoli's work on the Santa Maria Maggiore dome is so advanced that his successors and colleagues in painting, such as Velazquez, Pacheco and Murillo (EDGERTON, 2006) were unable, after several decades, to defy the Church's *status quo*, as the image of the smooth Moon, lacking all imperfections, reveals in their paintings on the Assumption of the Virgin (Figure 6).

Cigoli received all his knowledge during his artistic training from the Italian renaissance. The Renaissance reached its peak in the 16th century and deployed defined contours, perspectives, light and shadows to achieve the perfection of images. However, at the start of the 17th century Cigoli is caught within the transition phase between the Renaissance Art and Mannerism.

Figure 6 – "Immaculate Conception" by Velazquez (1618), Pacheco (1621) and Murillo (1660)

When perspectives are analyzed in the works of Cigoli (WOFFLIN, 2006), they do not fit within those used during the Renaissance, with defined lines and from one or more flight points. Perspective is the first conspicuous thing which, as applied in the Renaissance, actually fails to fit in the works of Cigoli (Figure 7). When two lines are drawn that converge to a determined point, the point of flight is found and thus, the visualization of the horizon line achieved. Although the point of flight lies at the feet of the Virgin, these elements seem to be doubtful since they may simply represent the trapezoid base for the moon.

In spite of a reduction in perspective effect, the picture confers a great depth which is achieved through the disposition of several images at the same layer, softened by a decrease in the lines that surround them and, consequently, a decrease of sharpness, according to the image's distance.

If in all Renaissance artistic works perfection was reached through the representation of all details, contrastingly Cigoli decreases his details within the images to which he desired to gain more depth. Consequently, he uses color changes and light and shadow effects in a somewhat different stance from that made during the Renaissance.

If Cigoli is the mature artist, between the Renaissance and Mannerism, including his studies on anatomy, why does his work shows an apparent regression in the art of perspective?

Perhaps this is not the right question. The existence of a book by the French sketcher Huret (1606-1670) is well known. It shows several applications of perspectives with special reference to anamorphoses schemes. Geometric deformations of images would give in certain angles the normal and three-dimensional perspective. Such art may be seen in the false dome of *Il Gesù* in Rome or in the picture "The Ambassadors", by Holbein (1497-1543) in the London National Gallery. Cigoli's oval moon, placed at the top of a rounded surface, seems to fit excellently within this technique since, the Moon may recover, in the observer's vision, its natural aspect, as seen in the sky (Figure 8).

Figure 8 – Detail of Cigoli's moon: left, as he painted it; center, the deformed figure; right, the re-deformed and spherical moon.

Cigoli did not seek perfection in his works but he merely desired to show the Moon as seen or should be seen by the naked eyes.

CONCLUSION: HYPOTHESES ON THE VARIOUS MOONS

According to the above, da Vinci believed that the Moon could disperse light as the Earth does, through the activity of the ocean waters, since he insisted that the moon's surface was furrowed.

Whereas through his *perspicillum* Galileo encountered in the heavens the failure of the Aristotelic-Thomistic world, his friend Cigoli painted on the cathedral's dome the Assumption of Mary on a moon as observed by Galileo.

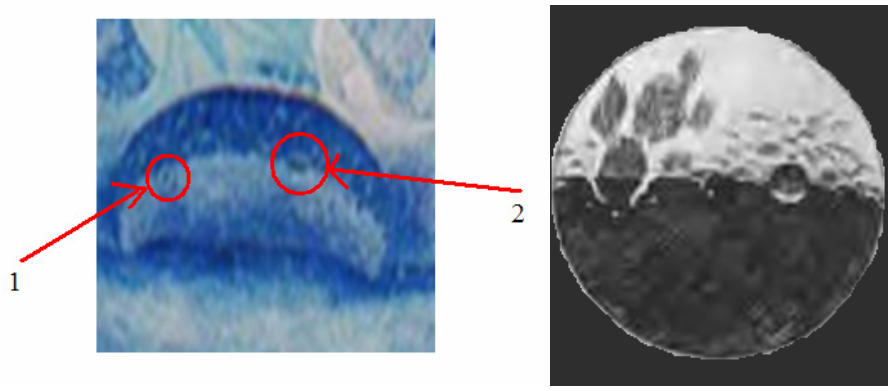
The following comprise the issues:

i) Did Galileo provide a telescope with great spherical or astigmatic aberrations so that Cigoli could paint the oval moon, far from the real thing? [It is known through the deposition of Prof. Galluzzi of the London Warburg Institute that Galileo spread various false evidences for the reproduction of telescopes so that competitors of the recently established scientific field could be misled];
ii) Are Cigoli's and Galileo's moon actually equivalent;
iii) Do Galileo's moons correspond to an almost photography of the Moon or is it merely a pictorial interpretation?

Our hypotheses on the above issues are:

i) Galileo was a friend of Ludovico Cardi and it would be very improbable that he gave his friend an astigmatic telescope. Probably the oval moon is an anamorphic technique to that by Huret;
ii) Figure 9 shows a similarity of the two moons due to the presence of a big crater at the right of the figure and on the left plateau.

Figure 9: Comparison between Cigoli's moon (left) and Galileo's moon (right)



iii) Comparing the Moon's photograph, we may see that a) Galileo painted the terminator line in a mistaken position; b) from the series of actual photographs of the Moon in Figures 10 to 12, bw and false colors, displacement of the terminator line to the left more than to

the right, reveals a smaller crater than that reproduced in Galileo's sketch. It may be concluded that the crater has never been reported since it never existed.

Figure 10 - Left, the moon in the southern hemisphere (first quarter); center, the same photograph with deformed moon (oval); right, photo of moon in the northern hemisphere

Figure 11 - Comparing Galileo's moons (center) with photographs of the Moon, with displacement of terminator line. Above, moons in bw; below in false colors (negative).

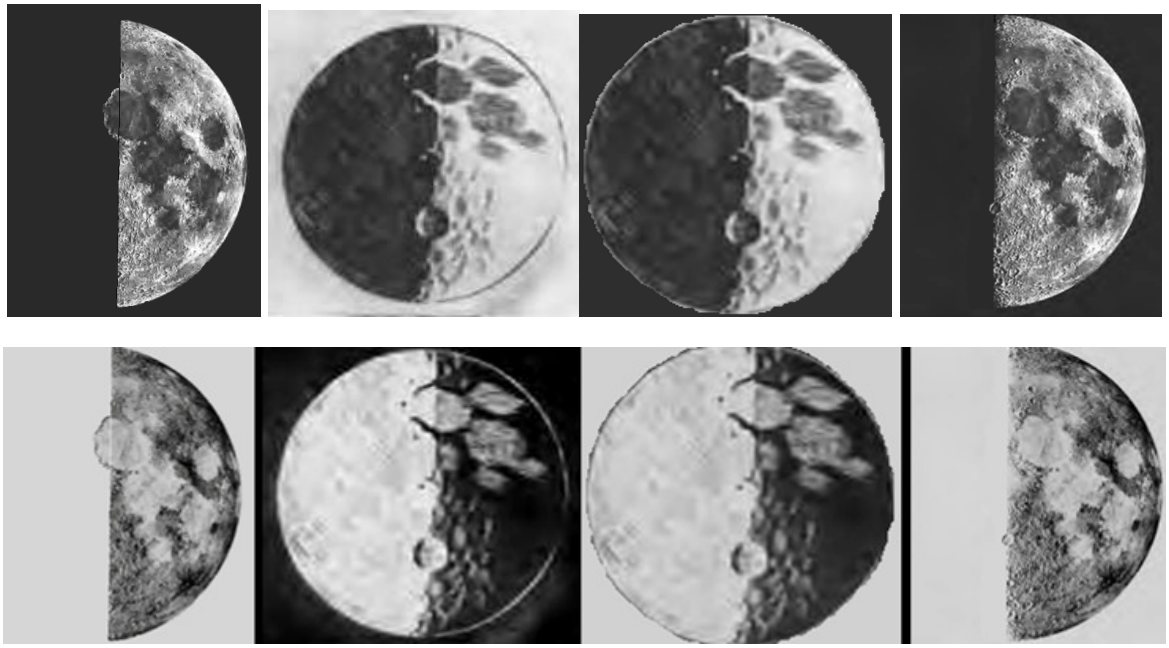
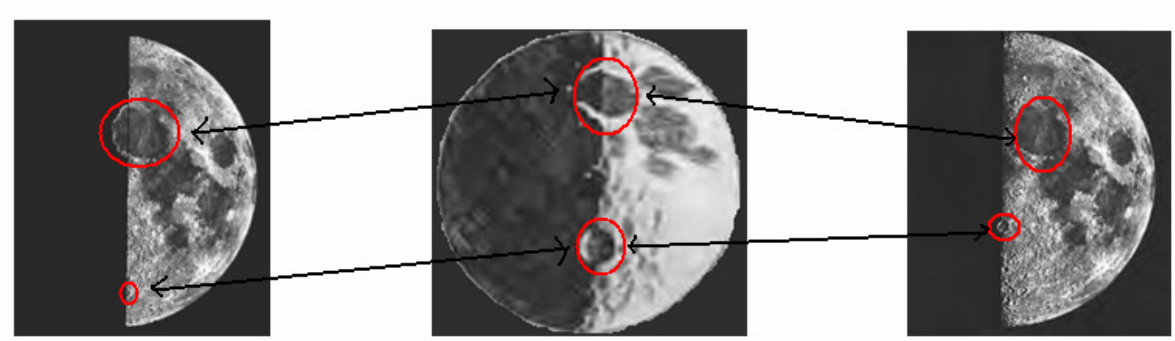


Figure 12 – Comparing inexistent craters



Above hypotheses show that Galileo's artistic education as a pupil at the Academia del Disegno, Florence, were so impressive that, immersed in the atmospheric perspective of the Da Vinci *sfumato*, made him exaggerate the crater's size so that the presence of mountains in the lunar disc, originally smooth and perfect, could be dramatically amplified. He exaggerated the blemishes of the heavens and tried to convince himself rather than the Church on this fact. It seems that Cigoli tried the same strategy making the perfection of the Virgin float over the imperfection and the corruption of the new lunar geography.

Such strategy failed and Galileo was condemned to house imprisonment in Arcetri; Cigoli blurred his craters in an undisclosed period and "corrected" the painting according to the old beliefs of the Aristotelic-Thomist world. Perhaps Science and Art have encounter in this episode their last respite.

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