



Picturing the Mind's Eye

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See the Bold-Shadow of Urania's Glory,
Immortal in His Race, no less in Story:
An Artist without Error, from whose Lyne,
Both Earth and Heav'ns, in sweet Proportion twine:
Behold Great Euclid. But, behold him well!
For 'tis in Him, DIVINITY doth dwell.
-G. Wharton,

Euclid's Elements of Geometry (1661)

No aphorism is more taken for granted in the world than "Seeing is Believing!" All human beings, both male and female of whatever race or ethnic heritage, have the same mechanically structured eyes, and, as far as the pure physics of vision are concerned, "see" identically. Even if individual vision happens to dysfunction for some physiological reason, it can usually be corrected by spectacles which work predictably and uniformly whatever the wearer's culture, because of the universal scientific laws of optical geometry first devised by the ancient Greek philosopher, Euclid (fl. 300 BC). Unlike so many ideas of the other great classical thinkers, Euclid's laws have never been altered or challenged – at least for explaining how we humans measure mother earth with our eyes. In other words, the healthy eyes of every normal person in the world perceive the same raw forms of images in the same perspective distance and size relationships just as the ancients demonstrated: that is, before the nurtured brain makes any psychological or ideological judgment as to their meaning.

Furthermore, every human being who has ever lived from Pleistocene times to the present, has experienced in vision the apparent convergence of parallel edges of objects as they extend away from our eyes and seem to come together in a single "vanishing point" on the distant horizon, as in the classic example of photographed railroad tracks in the following illustration.



How curious it is then that, even though we see "vanishing point" perspective phenomenon naturally, the notion to render it in artificial pictures is not inherent. The fact is that human beings generally, even those born with so-called artistic talent, are never automatically inclined to draw images in the same way we perceive them perspectively – that is, according to the geometric optical laws of vision. Geometric optical Linear perspective drawing is a special skill which must be **learned**, just like reading and writing in school. No matter how obvious the optical illusion of perspective convergence and its generally taken-for granted assumption in the Western-influenced world as being the trademark of pictorial "realism," it has rarely, and almost never outside this Western-influenced world, been of concern to artists before the Italian Renaissance. In fact, most non-Western artists, and even Western artists during the early Middle Ages, tended to render objects in "divergent perspective"! Tables, for example, were often depicted wider at the more distant end than at the nearer, simply because the artist preferred a larger area in order to display more objects on them!



Nevertheless, what is innate in the human artistic imagination, and is very evident in the art of children when they first begin to draw, is the instinct to indicate hierarchy; that is, to separate that which is of most importance to the picture's message, from that which is only incidental. This is usually accomplished by making the important figures larger than the others, and to render three-dimensional space as flat surface, with forms of objects supposed to be nearer at the bottom, and further away at the top, but with no particular size or scale differentiation due to separation by actual distance. Instead of a single viewpoint which orthodox linear perspective demands, the as yet unacculturated artist depicts the various objects in his/her picture as if viewed from multiple viewpoints. Each object is imagined not in spatial relation to one another, but separate and according to its own most characteristic aspect.



Here is a drawing by a five-year old that clearly shows these natural tendencies. The subject is the young artist's mother sleeping in a hammock with her pet cat perched at one end. Note how the child has drawn the mother as if suspended above the hammock, not nestled within it. The five-year old has instinctively realized that in order for the mother to be visible in the picture, she can not be occluded by the hammock, even though that was not the way she would naturally see her mother unless she climbed up in the tree and looked down.

It is exactly this "naïve" manner of representing visual "reality" that all people, beginning as children, imagine, and remains the basis of even the most sophisticated adult art everywhere in the world not influenced by Western perspective. Yet, even though Western art itself, especially during the Middle Ages was just as "naïve," most modern Westerners still tend to judge even the most sophisticated adult art of non-Western societies unfamiliar with Renaissance-style "realism" as "child-like," unconsciously if nonetheless pejoratively synonymous with "primitive." Westerners are too certain that because perspective is so rooted in scientific geometry, the "realism" it produces must be universally absolute. Its very "invention" in the West is unfortunately taken for granted as but another

example of Western scientific and cultural superiority.

Ironically, the advent of geometric optical perspective in art which occurred during the still medieval and still devout Italian Renaissance, was thoroughly inspired by the quite un-modern spiritual assumptions of European Christians. However, it should also be understood that even though linear perspective is not inherent, some sense that the visual world does possess geometric structure is innate in the brains of all human beings. While this propensity is usually manifested in abstract patterns in the arts of most civilizations, it also lays at the root development of Western art at the time of the Renaissance. In truth, the inception of geometric optical perspective was originally just as much a culture-nurtured concept as any of the other artistic conventions employed by other civilizations for making pictures; the unique “symbolic form” of Western European art as Erwin Panofsky described it many years ago.

We need now to inquire why and how the arts of the West took this peculiar geometric perspective path, while other cultures did not. The reason, as I would argue, wasn't because they could not, it was because they did not suffer the same psycho-religious crises of Western Europeans during the Middle Ages.

In any event, some time between 1413 and 1425, the Florentine sculptor, engineer, architect, and all-around artisan-impresario, Filippo Brunelleschi (1377-1446) painted two pictures, one smaller (about eleven-and-half inches square) showing the eastern façade of the Florentine Baptistery viewed frontally from the western portal of the city's Cathedral, and the other a larger panel of Florence's nearby government headquarters known as the Palazzo Vecchio, viewed obliquely from the north-west corner of the city's main public plaza.

Unfortunately, both paintings have been lost since the mid-fifteenth century. Their original subjects, however, are known to us through later verbal descriptions, but only one of which was by a witness who claimed to have actually seen the pictures. Nevertheless, based on this and the other second-hand accounts, several reconstructions have been proposed by modern scholars, including myself. These two lost panels, so far studied by only a few specialized scholars and hardly attracting the interest of even the most passionate lovers of Italian painting, were surely the most influential art works produced during the entire European Renaissance.

How dare I make such a claim? Because the geometric linear perspective scheme employed for the first time ever in each of these modest pictures utterly changed how artists of Western civilization represented “reality” for the next five hundred years. Even more astounding is the fact that the geometric-optical perspective method Brunelleschi first introduced here has managed also to change the very way people, especially those in Westernized societies, visually verify the phenomenal world in their acculturated mind's eye. In other words, Brunelleschi's perspective not only altered how we represent what we see, but how we actually see ***a priori***.

Within weeks after Brunelleschi's initial demonstration, his perspective method was adopted by some of the most talented artists of Florence, thence throughout Italy, and by 1600 was being learned and adapted by artists everywhere in transalpine Western Europe. By 1700, the perspective way of perceiving visual “reality” in the physical world was taken for granted as a universal, natural truth, as absolute as Isaac Newton's recently proven law of gravity.

Although Western artists finally began to eschew linear perspective by the mid-nineteenth century, as too “mechanical” and hindering “self-expression” (they were discovering, among other new ideas, aesthetic excitement in the more abstract art of non-Western cultures), Brunelleschi's original principles still remain the scientific basis for, and the reason why all the photographic arts, including cinema and electronically digitized images, are universally believable, no matter what the viewer's cultural pre-disposition.

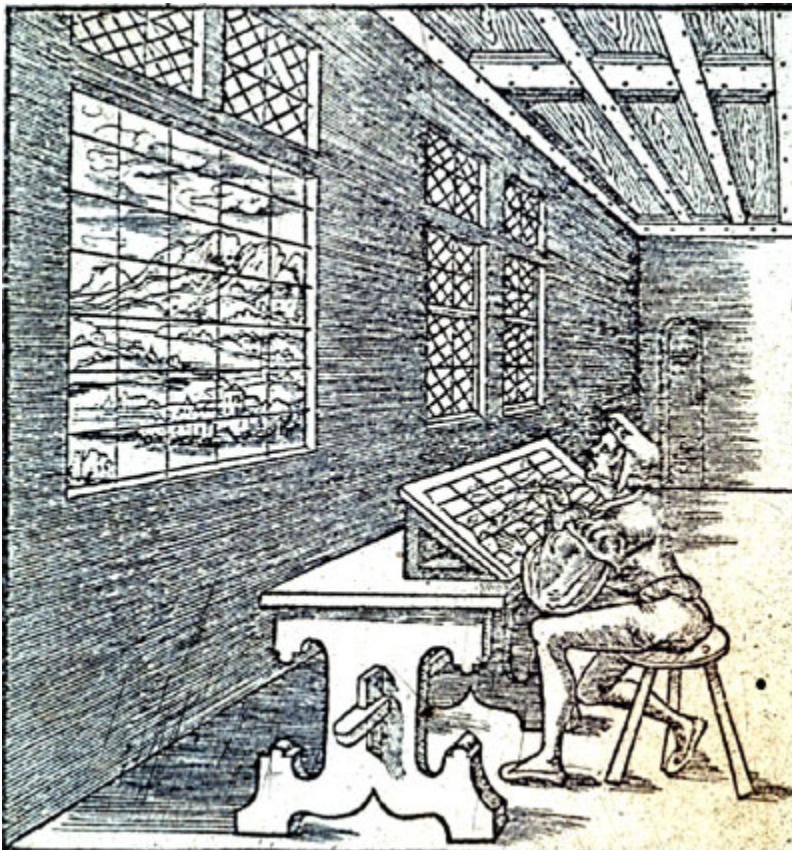
Curiously, however, the original public test as to how well Brunelleschi's first perspective image resembled the real Baptistery, according to the most detailed fifteenth-century account, was by comparing the picture not to the building itself, but to the painting's reflection in a mirror! Indeed, Brunelleschi's mirror was the key component signifying why he conceived of geometric-optical linear perspective in the first place, especially in the still profoundly religious ambience of medieval Florence. I believe Brunelleschi employed the mirror for the same reason as expressed by Saint Paul in his famous Epistle to the Corinthians, I, 13:12, “At present we see indistinctly, as in a mirror, but then [in heaven] face to face.”

As I would further stress, Brunelleschi's remarkable achievement, as he first understood it, was not the opening door to secular observation of objective nature as has customarily been claimed, but ironically a last gasp of the spiritual Middle Ages. It has been said that the Renaissance was the most medieval thing the Middle Ages invented. In truth, the fifteenth century was a time still yearning for a new means to stimulate the Faith after a bitter two centuries of political turmoil in the Church (the Schism) and ideological frustration (the failure of the Crusades and loss of Jerusalem). There was a still a desperate need to re-inspire Western Christians to stem expanding Islam, and even recapture the Holy Lands. Linear perspective should therefore retool the visual arts, refurbishing them to present the Christian message more convincingly and help shore up the sagging will of an increasingly

cynical population.

Yet another early contributor to the art-science of linear perspective stepped literally into the picture in 1435. He was the humanist scholar, Leon Battista Alberti (1406-1472), who in that and the next year, wrote two versions of a book *On Painting*, in Italian and Latin, the first such to treat the visual arts as an appropriate humanist subject, as worthy of the same intellectual study as the great classics of antique Greek and Roman literature. Alberti, who certainly accepted without question all the religious analogies between perspective optics and divine intention, nevertheless preferred to bring the matter more down to earth, as it were. The real advantage of Brunelleschi's pictorial method was that the very rigidity of its geometric structure must signify not just divine order but also human moral order. Alberti was so taken by the fecundity of the arts flourishing in Florence (he dedicated the Italian version of his book to Brunelleschi) that he now believed that painting in particular, if it followed the rules correctly, could provide ethical guidance to noble human behavior just as surely as the writings of Cicero.

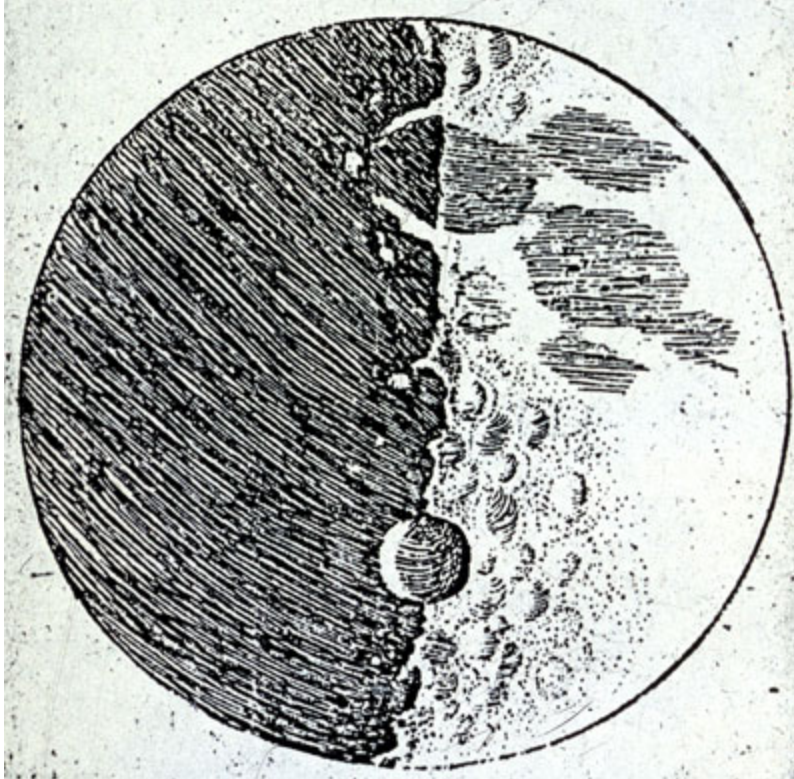
Alberti's actual perspective method was no more than a codification of Brunelleschi's method already in practice by a number of artists by 1435, but he did present it in the form of simple sequential steps which, as his treatise increasingly circulated in Italy and across the Alps, helped to proliferate the new art-science throughout Europe. His most original contribution, however, has ever since become known as "Alberti's window." In essence, even if inadvertent, it not only shifted the intention of a perspective painting away from "mirroring" nature as a mere reflection of God's true brilliance in heaven, to seeing nature directly through an open window, not as a divine mystery revealed by geometry, but as worldly perfection framed by geometry.



By the early sixteenth century, however, even as Alberti's "window" was accepted almost everywhere in Western Europe as providing the ultimate illusion of visual reality in art, Italian painters, while not abjuring the optical truthfulness of Alberti's perspective, nonetheless began to tire of its geometric rigidity. Furthermore, they were finding new visual excitement in creating the illusion not so much of depth but of frontal projection. This new fascination was remarkably encouraged by recent archaeological discoveries of ancient Roman relief sculpture, where figures were carved protruding from the surface of stone or plaster, lined side by side as if in lateral procession with their raised forms made visible by sharp contrast between lighted and shaded sides. Instead of simulating a "window" view of deep space beyond the pictorial surface, the ancient carvers created an equally "lifelike" illusion of forward projection, further emphasized by the shadows their forms cast against the background plane. This new archaeological fascination, especially after the 1520's, resulted in a widely popular "relief-like" style of classical painting in central Italy. Artistic mastery of this novel mode nevertheless still depended on knowledge of basic Albertian perspective as applied to the related

optical geometry of shadow casting, the laws of which had likewise been enumerated by Alberti in his 1435/6 *Treatise on Painting*.

Finally, let me fast forward to seventeenth-century Florence, nearly two hundred years after Brunelleschi's mirror and Alberti's window had impressed European art and thought. Here we encounter Galileo Galilei (1564-1642), the great astronomer and physicist, and by no coincidence a direct descendant of his native city's illustrious artistic tradition. In fact, Galileo was both a talented draughtsman and a teacher of perspective drawing. One of the lessons he studied and taught was how to draw a sphere with raised protuberances casting shadows on its surface in raking light. During 1609 and 1610, Galileo built himself a telescope, based on news of its prior invention in the Netherlands, where the novel instrument had attracted attention for its military possibilities, like spotting distant ships at sea. In England, Thomas Harriot, a renowned mathematician and explorer, even turned his version of the device, called appropriately a "perspective tube," on the moon, but saw nothing to change his still medieval mind that it was anything other than a perfect sphere with a "strange spottedness" that must be internal like the coloration of alabaster.



Galileo's own "perspective tube" was in effect no more than "Alberti's window" enhanced by magnifying lenses. He too aimed it at the moon, and as he evaluated what he observed, his own perspective drawing and teaching experience made it clear to him that Harriot's "strange spottedness" was really dark shadow cast by protruding mountains on the moon's irregular surface. To the startled public who read his book, *Sidereus nuncius* ("*Starry Messenger*") which he rushed into print in 1610, Galileo's "perspective tube" quite shattered "Brunelleschi's mirror." What Galileo's version of "Alberti's window" revealed was that the earth was not necessarily a pale reflection of the immaculate heavens as "Brunelleschi's mirror" proclaimed, but in the case of the moon just the other way around. Beyond any Jesuit doubt; that is, if one of them dared to look through his "perspective tube," Galileo proved that the first "planet" in Dante's magnificent ascent to the heavenly Empyrium, was hardly the "eternal pearl" described by the poet, but rather a most imperfect sphere, marred and crinkled just like the lowly earth.

Permit me now to pass this argument on to my student, David Butts, whose [following paper](#), written for a recent Williams College seminar on the subject of "Renaissance linear perspective," quite wonderfully shows how Galileo used his telescope to observe the equally strange revolving spots on the sun, and how once again linear perspective in art revealed scientific truth in nature.