Moon, Renaissance Image of the

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Abstract
The history of modern selenography, i.e., the study of the surface and astrophysical features of the Moon, can find its beginning with the neglected contribution of William Gilbert at the start of the seventeenth century and its conventional end with the work by Giambattista Riccioli and Francesco Maria Grimaldi 50 years later, with the inevitable mention to the revolutionary telescopical discoveries by Galileo and to the milestone published on the subject by Johannes Hevelius in between. The interest regarding Earth’s unique satellite and its conformation, however, is certainly more ancient, and it was undoubtedly kept alive and brought forth also thanks to the contribution of many other unnamed observers besides the greatest astronomers of the Western tradition, e.g., for meteorological, astrological, and religious reasons that the scientific surveys of the Moon usually did not take account of.

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Innovative and Original Aspects
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(1) looking for a proof that the Moon has its own unbound orbit around the Earth and was not moved passively as embedded in a solid geocentric sphere; (2) detecting changes in the appearance of the lunar disc in order to shed light on its apparent oscillation (a phenomenon known as “libration,” i.e., the small but notable apparent movement of the moon in its monthly orbit, that seems to happen in longitude and in latitude, which he noticed, without a telescope, 40 years before Galileo); and (3) accumulating observational evidence for solving through its reference the urgent problem of determining longitude during navigation (Pumfrey 2009, 2011). Moreover, he gave a first geographical nomenclature to some regions of the Moon (an onomastic schema that somehow reminded British imperialism of that age), since Gilbert thought that the satellite was not entirely constituted by water, but also of extensive lands, that were awaiting to be colonized.

Before him just Leonardo da Vinci drew naked-eye sketches of the Moon, being convinced that “the part of the Moon that shines consists of water” and that its spots were shadows caused by the Moon’s clouds on its oceans (and not, as it was thought, mirror-like reflections of the Earth on Moon’s surface). Perhaps Girolamo Fracastoro had a more clear idea of the Moon’s appearance before them, because, as he wrote in his Homocentrica (1538), he had the chance to observe it through a magnifying glass (van Helden 1977, pp. 17, 28).

However it was the British mathematician Thomas Harriot that made the first known telescopic sketch of the Moon in July 1609, albeit unpublished at that time. After his reading of Galileo’s Sidereus Nuncius, Harriot pursued an even better prospect of the satellite with the help of his friend William Lower. In fact, among his notes there is an annotated drawing of the full moon face, as result of his 1611–1612 observations, although very poor in detail (probably because of the rudimentary 6x telescope he used).

On the 30th of November, 1609, Galileo turned his own built telescope – an instrument capable of 20-power magnification – toward the satellite, noticing with great excitement that, as he wrote, “the Moon is by no means endowed with a smooth and polished surface, but is rough and uneven and, just as the face of the Earth itself, crowded everywhere with vast prominences, deep chasms, and convolutions.” What have been called for centuries “maculae” or “lunar spots” revealed themselves as actual horographical features for the first time, and the Moon no longer appeared at his eyes as a polished, translucent crystalline sphere. Thus Galileo drew his famous sepia ink-wash watercolors in order to show how progressed the pattern of illumination and the shadow line (or “terminator”) as the angle of incidence of solar light was changing there. It has been recognized how much Galileo’s drawings of the Moon bears signs of Renaissance pictorial techniques (shading, perspective, etc.) and awareness of coeval map-making conventions (marked coastlines, darkened lakes, etc.). Those illustrations remained the unsurpassed standard for nearly 20 years, both for scientists (Scheiner, Malapert, Biancani, Borri) and for artists (Cigoli, Elsheimer). Also in the original four copperplate engravings from the first edition of Sidereus Nuncius, it can be appreciated the esthetic quality and the detail, e.g., the typical light-and-shade pattern produced by obliquely illuminated craters, then lost in the subsequent prints. However Galileo altered many lunar details in order to reach a higher explanatory effect, stylizing or exaggerating the size of lunar features, and that happened “because they were meant as illustrations of his verbal arguments about the Moon’s nature” (Winkler and Van Helden 1992, p. 107) and not as neutral, objective depictions (this in part explains some macroscopic omissions remarked by his successors and critics, such as Mare serenitatis, from the final renderings). In 1632, after reiterated observations Galileo was aware of lunar libration too. Despite Galileo’s discoveries, scholastic theologians were at first neither ready nor available to accept any revision of the traditional aristotelian-avverroistic theory, since they maintained that those discoveries were not sufficient to invalidate secular strongholds, such as Moon’s essential incorruptibility and its facing the sublunar world as cause of its one-side imperfection (Ariew 1984, 2001; Wilson 2001).
The Jesuit Christophorus Clavius rather tried to restore the traditional view recovering the thesis of different density in lunar material as the reason for the detectable spots, since in medieval times Averroes, as Avenatha (Ibn Ezra) before him, linked the nature of the Moon with that of the Earth and believed that the Moon was constituted by more or less dense parts of incorruptible substance, which consequently receive the light of the sun and release it with a sort of fluorescence with different intensity – and that is because they retained that spots could be seen on its surface (Duhem 1985, pp. 481–482).

Well before the beginning of telescopic astronomy, Kepler conjectured that the Moon was a celestial body similar to the Earth. In fact, noticing the evolving irregular patterns of light and shadow on the surface of the Moon, Kepler reached the same conclusion as Galileo’s, albeit speculatively, in his Astronomia pars optica (1604). Moreover in his Dissertatio cum Nuncio Sidereo (1610), he underlined that many results among Galileo’s conclusions had been anticipated by previous astronomers and in part by himself too. For instance, he said the idea that the Moon’s superficial conformation is similar to the Earth’s surface could be traced back to second century AD, when Plutarch wrote his treatise On the Face which appears on the Orb of the Moon.

Some perplexities were raised by Galileo’s discovery of the so-called secondary light of the Moon, which he noticed as detectable during lunar eclipses. On this issue, in 1626 Bartholomew Amicus maintained, again with Averroes, that the Moon receives its light from the Sun and incorporates it within its own smooth body, making that light its own light. The following year Raphael Aversa thought on the contrary that the Moon lacked an innate light since it cannot acquire solar light because its surface was considered perfectly transparent, albeit with more or less opaque zones. Aversa also disregarded Galileo’s theory of the “secondary light” of the Moon as solar light reflected on the satellite by the Earth. For him, as for many other seventeenth-century scholastic authors, “Moon’s secondary light... comes from the surrounding parts of the heavens, seemingly from sunlight reflected to the Moon from other celestial bodies,” Earth excluded (Grant 1994, p. 406).

Galilean observations gained a wide echo also in arts, as it is emblematic in the fresco The Virgin of the Immaculate Conception depicted with great license by Lodovico Cigoli on the Cappella Paolina in the Roman church of Santa Maria Maggiore (1610–1612), since it shows a cratered and maculate Moon, much as it appeared in Galileo’s drawings (Ostrow 1996). However it was in the field of literature that the Moon as new object of discovery and daydreaming phantasies gained the larger space. For, fictional accounts of imaginary travel to the Moon, whose archetypical model was Lucian’s Alēthē diēgēmata (True Stories) dating back to the second century AD, were so numerous in Renaissance that can only be listed here, starting with the famous XXXIV canto of Ludovico Ariosto’s Orlando Furioso (1532), to subsequent other contributions as Ben Jonson’s Newes from the New World Discover’d in the Moone (1620); Kepler’s Somnium (posthumous publ. in 1634, but composed in 1609), Francis Godwin’s The Man in the Moone, or a Discourse of a Voyage Thither by Domingo Gonsales, the Speedy Messenger (1638), Cyrano de Bergerac’s L’autre Monde: Les Etats et Empires de la Lune (1649), Pantaleón de Ribera’s satirical Vexamen de la Luna (1626), John Wilkins’s The Discovery of a World in the Moon (1638, where, as in Somnium, it was imagined that the Moon was inhabited), etc. (cf. Nicolson 1948; Romm 1989; de Armas 1999; Bezzola Lambert 2002; Chen-Morris 2005; Houston 2010).

Between January 1637 and December 1638, working on Kepler’s hypotheses on planetary motion, a 20-year-old Jeremiah Horrocks was the first to demonstrate that the Moon moved in an elliptical path around the Earth by analogy to the motions of a conical pendulum, and on this issue he also anticipated Isaac Newton in suggesting the gravitational influence of the Sun, as well as the one of the Earth, on the Moon’s orbit (Wilson 1987a, b).

Between 1628 and 1637, Nicolas-Claude Fabri de Peiresc e Pierre Gassendi, with the help of the painter Claude Mellan, undertook a major project

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of accurate depiction of the lunar face as an aid for determining the precise longitude on the Earth in its reference. The project was partially completed with three engravings that were undoubtedly successful from the artistic point of view but in a way that was almost useless for the astronomical needs that it was planned for.

In order to solve the same problem, the cosmographer and map-maker Michael Florent van Langren produced what is generally regarded as “the first true map of the Moon” (Whitetaker, p. 128), whose first version was completed in 1645 with an entire new set of nomenclature for the depicted lunar topography, denominated after the names of eminent people – “the basic scheme of nomenclature that is used to this day” (ibid., p. 129). No matter how remarkable, this result was soon superseded by Hevelius’ groundbreaking map.

In fact, the real game-changer in the field was the publication of Johannes Hevelius’ Selenographia: sive Lunae Descriptio (1647), which really rose the bar in Moon observation and depiction thanks to his own built 40x telescope that did not suffer of spherical nor chromatic aberration. “Selenographia remained the standard work of reference on the subject for well over a century” (Whitetaker, p. 134), being “truly one of the greatest publications in all seventeenth-century European astronomy” (Montgomery, p. 173). There Hevelius showed the entire lunar face, also comprehensive of the libration zones, with no shadows, as if it were homogeneously enlighten from a unique source of light. From observation to the printing of the engravings, everything was under his control, as unprecedented guarantee of reliability of the visual evidence provided to the readers. The esthetic quality of his scientific illustrations was impressive, even though the baroque size of his plates struggled to preserve the precision of details for necessary longitude measurements. He proposed new names of lunar features inspired by classical characters and figures on the basis of presumed and idealized similarities with respective areas of the Earth. He even thought that certain areas were inhabited, while others were regions of volcanic activity.

In 1649 Eustachio Divini arranged a broadsheet of a full Moon, correcting and improving a bit Hevelius’ work. The following year, Gerolamo Sersale offered another large image of the lunar face, adding new details on Hevelius’ map and thus improving on his turn the topographical knowledge in that regard. But it was only when another Jesuit – Giambattista Riccioli – contributed to the research providing what would have been a new, monumental classic on the subject, namely, the ambitious Almagestum Novum (1651), that a new reference-text came on the market raising the selenographical standard to an unprecedented level. Riccioli’s work was equipped with new and more precise maps of the satellite provided by his assistant Francesco Maria Grimaldi, correcting many errors of almost all their predecessors and restoring an expanded version of van Langren’s naming schema. The positive reception of this achievement was so wide that it finally imposed its naming over Hevelius’ one, after a long period in which the two works were used as parallel reference.

Finally, while in his Questions on De caelo (1657) the German Jesuit Melchior Cornäus rejected the existence of lunar epicycles and assumed that the Moon moves through a fluid medium, the fact that the Moon always exhibits the same face to earthly observers was explained by Otto von Guericke in his Experimenta nova (1672) rejecting the superseded epicycles theory with the idea of an attractive force emanating from the Earth which holds the Moon in its orbit so that the same face is always the one seen.

Cross-References

▶ Astronomy
▶ Clavius, Christophorus
▶ Galilei, Galileo
▶ Hevelius, Johannes
▶ Kepler, Johannes – Renaissance Philosophy
▶ Riccioli, Giambattista
▶ Telescope
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