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RESEARCH ARTICLE

Universal enough: the politics of nomenclature in seventeenth-century selenography

Nydia Pineda de Ávila

Department of History, University of California San Diego, USA
Email: npinedadeavila@ucsd.edu

Abstract

Selenography was both a practice and a tool which developed through optical instrumentation in the seventeenth century. As a practice, it was the process of creating composite graphical depictions of the Moon through skill and sustained telescopic study. As a paper-based tool, the focus of this article, a selenography was a stabilized visualization and codified template for making, organizing and communicating lunar-based astronomical observations. The template's key observation and notation device was its system of named Moon spots, or lunar nomenclatures. Such systems varied significantly in different sites of knowledge making. Through the close study of two naming schemes produced and exchanged in Counter-Reformation contexts by Michael van Langren (1645) and Giovanni Battista Riccioli in collaboration with Maria Francesco Grimaldi (1651), this essay argues that selenographies were conceived with an eye to ideals of universal standardization for collective and even global observation. In practice, however, different forms of universality, revealing distinct local agendas tied to political and religious priorities, were materialized in each competing scheme.

Early selenographies, alongside other early modern visualizations studied within the rising field of graphical epistemology, have primarily been understood as virtual witnesses; as pictorial devices with the rhetorical power of vividly and persuasively conveying experimental scenes and observed phenomena. These graphics, it has been argued, were used to secure epistemic legitimation.[1] Such a reading speaks largely within a historiography concerned with the creation of epistemic techniques for securing consensus and truth.[2] To contribute

[1] Mary Winkler and Albert Van Helden, 'Hevelius and the visual language of astronomy', in Judith V. Field and Frank A.J.L. James (eds.), *Renaissance and Revolution: Humanists, Scholars, Craftsmen and Natural Philosophers in Early Modern Europe*, Cambridge: Cambridge University Press, 1993, pp. 97–116; Janet Vertesi, 'Picturing the moon: Hevelius and Riccioli's visual debate', *Studies in History and Philosophy of Science* (2007) 38, pp. 401–21; Kathrin Müller, 'How to craft telescopic observation in a book: Hevelius's *Selenographia* (1647) and its images', *Journal for the History of Astronomy* (2010) 41, pp. 355–79. For a nuanced analysis of the virtual witnessing argument from the consideration of graphical epistemology see Thomas Haddad, 'Maps of the moon: lunar cartography from the seventeenth century to the Space Age', *Map History* (2019) 1(2), pp. 1–95, 20–58.

[2] Steven Shapin, 'Pump and circumstance: Robert Boyle's literary technology', *Social Studies of Science* (1984) 14(4), pp. 481–520. See also Lorraine Daston, 'Epistemic images', in Alina Payne (ed.), *Vision and Its Instruments: Art, Science, and Technology in Early Modern Images*, Philadelphia: Pennsylvania State University Press, 2015, pp. 13–35; Alexander Marr, 'Knowing images', *Renaissance Quarterly* (2016) 69(3), pp. 1000–13; Horst Bredekamp, Vera Dünkel and Birgit Schneider (eds.), *The Technical Image: A History of Scientific Imagery*, Chicago and London: University of Chicago Press, 2015.

to a more granular historical account of the history of early modern epistemic images and observation practices, this essay will examine selenography's mutually embedded technical and rhetorical components. It argues that the relationship between those parts was intrinsically tied to the politics of scientific practice. In conversation with previous surveys of the development of early selenography, its focus is situated in the context of production.[3] Emphasis is laid upon the site-specific importance of lunar nomenclatures, which were selenography's basic notation and observation codes.

This discussion unfolds through the exploration of two competing maps produced in the mid-1640s, when selenographies with systematized nomenclatures began to contend in print. It will focus on the context of scientific practices in the Catholic Counter-Reformation. The first case of my inquiry, published in the broadsheet *Plenilunii Lumina Austriaca Philippica* (Brussels, 1645) by the cosmographer Michael van Langren, is set within the overlapping spheres of religion, scholarship and government that connected Spain and Flanders on the eve of the Treaties of Münster.[4] Second is the lunar nomenclature made by professors of the Jesuit College of Santa Lucia in Bologna, Giovanni Battista Riccioli and Maria Francesco Grimaldi, published in Riccioli's ambitious mathematical encyclopedia, the *Almagestum Novum* (Bologna,1651).[5] These two cases shared instrument-making practices and communication circuits. Van Langren was surrounded by advisers who were either ecclesiastics of the Society of Jesus or laymen trained within that institution, especially in the networks of the Jesuit mathematical schools in Antwerp, Louvain and Madrid. Riccioli and Grimaldi, on the other hand, were educated in the mathematical culture of Christoph Clavius (1538–1612), who gave astronomy unprecedented prestige in Counter-Reformation politics.[6]

A note of caution: previous examinations of early modern lunar nomenclatures have evaluated them in terms of their success; that is to say, on the basis of which schemes competed and prevailed in European protocols of astronomical observation throughout the seventeenth century and beyond.[7] In contrast, I will interrogate the way in which nomenclatures embodied the technical, rhetorical and political agendas of their makers. The selection of case studies does not intend to argue that selenographies produced in Catholic contexts materialized personal, political or religious agendas more than those produced in Protestant contexts. Instead, I aim to contribute to a better understanding of the variety of agendas that coalesced under the astronomical projects within the Roman Catholic world. My objective is to show that, albeit an extended sphere of shared technical questions, instrumental practices and epistemic ideals with universal

[3] Ewen Whitaker, *Mapping and Naming the Moon*, Cambridge: Cambridge University Press, 1999; Robert H. van Ghent and Albert van Helden, 'Lunar, solar, and planetary representations to 1650', in John B. Harley and David Woodward (eds.), *The History of Cartography*, vol. 3: *Cartography in the European Renaissance*, Chicago: University of Chicago Press, 2007, pp. 123–34; Haddad op. cit. (1).

[4] Michael van Langren, *Plenilunii Lumina Austriaca Philippica*, Brussels: s.n., 1645.

[5] Giovanni Battista Riccioli, *Almagestum novum*, Bononiae: Ex typographia hæredis Victorii Benatii, 1651.

[6] Omer van de Vyver, 'L'École de mathematiques des Jesuites de la Province Flandro-Belge au XVIIe siècle', *Archivum Historicum Societatis Iesu* (1980) 49, pp. 265–77; Ad J. Meskens, *Between Tradition and Innovation: Gregorio a San Vicente and the Flemish Jesuit Mathematics School*, Leiden and Boston: Brill, 2021; Ugo Baldini, 'La formazione scientifica di Giovanni Battista Riccioli', in Luigi Pepe (ed.), *Copernico e la questione copernicana in Italia dal XVI al XIX secolo*, Florence: Leo S. Olschki editore, 1996, pp. 123–82; Baldini, 'Riccioli e Grimaldi', in Maria Teresa Borgato (ed.), *Giambattista Riccioli e il Merito Scientifico dei Gesuiti nell'età Barocca*, Florence: Leo S. Olschki, 2002, pp. 1–48; Alfredo Dinis, 'Giovanni Battista Riccioli and the science of his time', in Mordechai Feingold (ed.), *Jesuit Science and the Republic of Letters*, Cambridge, MA: MIT Press, 2003, pp. 195–224.

[7] Whitaker, op. cit. (3); Peter van der Krögt and Fermjan Ormeling, 'Michiel Florent van Langren and lunar naming', in *Actes del XXIV Congrès Internacional d'ICOS sobre Ciències Onomàstiques. Annex. Secció 8*, at www.gencat.cat/llengua/BTPL/ICOS2011/190.pdf (accessed 19 April 2024).

aspirations, different schemes for lunar observation and notation were articulated through local priorities which were ultimately political.

Designing a legible grid for lunar observation

Seventeenth-century selenographies can be associated with early modern paper instruments designed to fulfil a variety of didactic and heuristic functions addressing demonstrative, argumentative, mnemotechnic and observational needs.[8] These artefacts were valuable commodities in patronage cultures and the print economy, and in this sense they were also instruments of prestige. With methods known to early modern botany, anatomy and antiquarianism, producing a telescopic picture of the Moon relied on comparing and collating as many as possible piecemeal sketches of lunar phases made over time by different people in varied instrumental and observation conditions.[9] Selenographers (who also identified broadly as 'astronomers', 'mathematicians', 'cosmographers' and 'natural philosophers') appropriated different styles related to diagrammatic, cartographic and naturalistic pictorial modes. Pictorial rationale relied on a variety of factors, including authorial intention, artistic skill and patron–client relations.[10]

Artfully contrived, a selenography was a technical device designed to help record the movement of celestial bodies against specific parts of the visible lunar disc.[11] This tool enhanced methods for calculating planetary distances, terrestrial longitude and other astronomical questions through the ideals of accurate instrumentation and standardized collective observation. Selenographies were widely promoted by their makers as methods for the determination of longitude. More comprehensively, however, they were made to measure and represent changes of space over time, a basic preoccupation for early modern astronomy, as Thomás Haddad has argued in his excellent essay.[12] The lunar graphic would serve as a template for the Moon's changing shape in the sky, against which the passing of a planet or the progression of an eclipse could be geometrically described and recorded. With the assistance of the telescope, the satellite's most prominent regions or maculae (a Latin term used technically in optics to refer to spots or blurs) could be used as enhanced referents for observation and notation. Maculae served, for instance, to note precisely at what time the Earth's shadow touched a certain region of the lunar disc during an eclipse. They could also help the observer trace imaginary lines between a star or planet and a precise spot on the edge of the Moon. Such observations informed the most technical issue that selenographers aspired to resolve: a full understanding of the satellite's motion and, especially, of its libration.[13]

[8] Richard L. Krammer, 'Experimenting with paper instruments in fifteenth- and sixteenth-century astronomy: computing syzygies with isotemporal lines and salt dishes', *Journal for the History of Astronomy* (2011) 42(2), pp. 223–58; Samuel Gesner, 'The use of printed images for instrument-making at the Arsenius Workshop', in Nicholas Jardine and Isla Fay (eds.), *Observing the World through Images: Diagrams and Figures in the Early-Modern Arts and Sciences*, Leiden and Boston: Brill, 2014, pp. 124–79; Alexander Marr, 'Ingenuity in Nuremberg: Dürer and Stabius's instrument prints', *Art Bulletin* 100(3), pp. 48–79; Susan Dackerman (ed.), *Prints and the Pursuit of Knowledge in Early Modern Europe*, Cambridge, MA: Harvard Art Museums, 2011.

[9] Stephanie Moser, 'Making expert knowledge through the image: connections between antiquarian and early modern scientific illustration', *Isis* (2014) 105(1), pp. 58–99.

[10] Vertesi, op. cit. (1); Müller, op. cit. (1).

[11] Pierre Gassendi, *The mirrour of True Nobility & Gentility being the Life of the Renowned Nicolaus Claudius Fabricius Lord of Peiresc* (tr. W. Rand), London: Printed by J. Streater for Humphrey Mosely, 1657, pp. 129–32.

[12] Haddad, op. cit. (1), pp. 9–10.

[13] Jaroslaw Wlodarczyk, 'Libration of the Moon, Hevelius's theory, and its early reception in England', *Journal for the History of Astronomy* (2011) 42(4), pp. 495–519. Haddad, op. cit. (1), pp. 41–58.

Selenographies were syntheses of observations stabilized on paper graphics. They helped train and anchor the astronomer's eye. Specific spots were learned by heart so that at the telescope skilled observers would have a more or less detailed mental map for recording celestial phenomena. Just as geographical information was communicated without the need of an actual map, selenographic observations were conveyed through tables with hours, minutes and seconds that indicated temporal changes of light over discrete spots of the lunar disc. These tables allowed information to be shared, interpreted and contested effectively, to compete and to make claims.[14] Ideally, people in different parts of the world would share the same nomenclature to record, compare and contrast celestial observations described by others. Therefore, to ensure reliable identification, notation and communication, naming schemes had to be memorable and resistant enough to stick in the minds of users pertaining to different nations, religions and languages. Nomenclatures also needed to hold currency for an extended period of time.

Designing a lunar nomenclature was a similar challenge to the one that faced those seventeenth-century astronomers dedicated to stellar mapping. Johann Bayer voiced the need for an unbiased universal system of numerical notation for stellar identification in his elaborate constellation atlas *Uranographia*.[15] In his legacy, Johannes Hevelius, the author of *Selenographia* (Gdańsk, 1647), who was also devoted to mapping the constellations of the full northern hemisphere t, likewise alerted his readers to the need of a universal nomenclature.[16]

Generally selenographers acknowledged that a variety of naming systems would hinder their desire for concerted global observation. Nonetheless, in contrast with the author of *Uranographia* they developed arbitrary naming strategies. Their schemes depended neither on spatial location nor on perceptible qualities such as dimension, shape, opacity or luminosity. Selenographers did not project classical mythology or explicitly use referents from Scripture to name lunar spots, as did Wilhelm Schikard and Julius Schiller, the Protestant and Catholic compilers of stellar charts who reshaped and renamed classical Ptolemaic constellations by projecting biblical figures from the Old and New Testaments.[17] However, the inseparable politics of scholarship and religion did play a role in the production, publication and dissemination of lunar nomenclatures.

Selenographers loosely grounded their nomenclatures on a comparison with geography: the language game behind the naming systems conveyed that the Moon, like the Earth, was composed of water and land formations. This image of an earthly Moon did not arise from the development of the telescope; it was a conception discussed in classical philosophy, which was reworked in Arabic and late medieval optics.[18] As Pantin and Fabbri have argued, this *topos* gained new significance in early modern natural philosophy.[19] The analogy deeply informed observation practices in the seventeenth century. The Earth–Moon association was emphasized for a variety of epistemic and argumentative purposes in renowned works such as Galileo's *Sidereus Nuncius* (Venice, 1610) and *Dialogue Concerning the Two Chief World systems*

[14] For instance, William Molyneux's observation of the lunar eclipse of 19 November 1686 recording fifteen spots: Royal Society, Cl.P. 8i/36, 'Eclipsis lunae observata Dublinii Nov. 19 1686'. Also in RS Register Book 6, p. 342.

[15] Johann Bayer, *Explicatio characterum aenis uranometrias imaginum*, Augustae Vindelicorum: Typis Johannis Praetorii, 1654, p. [A4 v].

[16] Johannes Hevelius, *Selenographia sive lunae descriptio*, Gedani: Autoris sumptibus, Typis Hünefeldiani, 1647, pp. 222.

[17] Wilhelm Schikard, *Astroscopium pro facillima stellarum cognitione noviter excogitatum*, Stuttgardiae: Typis Kauttianis, 1646; Julius Schiller, *Coelum Stellatum Christianum*, Augustae Vindelicorum: Praelo Andreae Apergeri, 1627.

[18] Roger Ariew, 'Galileo's lunar observations in the context of medieval lunar theory', *Studies in History and Philosophy of Science* (1984) 15(3), pp. 213–26.

[19] Galileo Galilei, *Le messenger celeste* (tr. Isabelle Pantin), Paris: Les Belle Lettres, 1992, pp. lii–lxxxviii; Natacha Fabbri, 'The Moon as another Earth: what Galileo owes to Plutarch', *Galilaeana* (2013) 9, pp. 103–35.

(Florence, 1632). In Johannes Kepler's studies in optics and lunar motion, which were relevant to the selenographic practice, theories were frequently expounded through the Earth–Moon analogy.[20]

The Earth–Moon analogy appropriated by selenographers carried contentious implications and spurred lengthy debates in university and courtly contexts well into the mid-seventeenth century.[21] It was a proposition that challenged the theory of quintessence favoured in early modern Aristotelian natural philosophy taught in universities. According to this theory, the planetary bodies that moved in spheres around the Earth were made of eternal and incorruptible matter, whereas the Earth, made of four elements, was a realm of corruption and regeneration. In this theory, the Moon's sphere was necessarily smooth and unblemished. Therefore arguing that the satellite was similar to the Earth destabilized such a cosmological system. Breaking with the tradition of quintessence, the Earth–Moon analogy could be used as an argument to support the fluidity of the heavens, the infinity of worlds, and the movement of the Earth, among other cosmological controversies. For theologians, stating that the Earth was like the Moon vastly complicated the relationship between Scripture and physics. For all these reasons, drawing parallels between the Moon and the Earth found resistance in both Protestant and Catholic circles throughout the seventeenth century.[22]

Despite these controversies, the comparison between the Earth and the Moon provided a common ground for selenography because it worked as a heuristic framework. Regardless of cosmological commitments, the simile gave observers guidelines for understanding the blurry telescopic views through optical principles. In the 1640s, John Wilkins synthesized the basic hypotheses used to translate light effects as topographic features in *The Discovery of a New World*. If the Moon, like the Earth, was a solid sphere covered by land and water, then the brighter parts of the Moon would be land, which reflects light, while the Moon's most opaque regions would be water, because this element refracts light. Other analogies with light behaviour on irregular surfaces triggered various nuanced hypotheses about hollows and reliefs on the satellite's surface.[23]

The Earth–Moon analogy was not only an optical-research method; it also provided selenographers with a communication strategy. Large regions of the Moon were named

[20] Galileo Galilei, *Sidereus Nuncius*, Venetiis: Apud Thomam Baglionum, 1610, pp. 7v–12v; Galileo, *Dialogue Concerning the Two Chief World Systems – Ptolemaic & Copernicana* (tr. Stillman Drake), Berkely and Los Angeles: University of California Press, 1953, pp. 62–101; Johannes Kepler, *Ad vitellionem paralipomena, quibus astronomiae pars optica traditur …* Frankforti: Apud Claudium Marnium & Haeredem Ioannis Aubrii, 1604, p. 150; Kepler, *Narratio de observatis a se quatuor Jovis Satellitibus erronibus*, Frankforti: Sumtibus Zachariae Palthenii D, 1611, [*6]; Kepler, *Somnium seu opus posthumum de astronomia lunari*, Frankfurt: Sumptibus haeredum authoris, 1634, pp. 80–96; Kepler, *Kepler's Conversation with Galileo's Sidereal Messenger* (ed. and tr. Edward Rosen), New York: Johnson Reprint Corporation, 1965, pp. 13, 24, 26; Kepler, *Kepler's Somnium: The Dream, or Posthumous Work on Lunar Astronomy* (ed. and tr. Edward Rosen), Madison and London: University of Wisconsin Press, 1967, pp. 155-67.

[21] William Shea, 'Looking at the Moon as another Earth: terrestrial analogies and the seventeenth century', in Fernand Hallyn (ed.), *Metaphor and Analogy in the Sciences*, Dordrecht: Kluwer, 2000, pp. 83–103; James Lattis, *Between Copernicus and Galileo: Christoph Clavius and the Collapse of Ptolemaic Cosmology*, Chicago: University of Chicago Press, 1994, pp. 180–204; Isabelle Pantin, 'Le débat sur la substance lunaire après le *Sidereus Nuncius*', in Chantal Grell (ed.), *La lune aux 17e et 18e siècles*, Turnhout: Brépols, 2013, pp. 103–20; Eileen Reeves, *Painting the Heavens: Art and Science in the Age of Galileo*, Princeton, NJ: Princeton University Press, 1997, pp. 40–60, 138–84; Reeves, 'Kingdoms of Heaven: Galileo and Sarpi on the celestial', *Representations* (2009) 105, pp. 61–84; Horst Bredekamp, *Galileo's Thinking Hand: Mannerism, and the Virtue of Drawing in the Foundation of Early Modern Science*, Berlin and Boston: De Gruyter, pp. 101–10.

[22] Riccioli, op. cit. (5), pp. 186–8; Hevelius, op. cit. (16), pp. 109–52; John Wilkins, *The Discovery of a New World*, London: John Norton for John Maynard, 1640, pp. 70–90; Henry Stubbe, *A specimen of some animadversions upon a book entitled Plus Ultra*, London, s.n: 1670, pp. 34–40.

[23] Wilkins, op. cit. (22), pp. 101–8.

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seas and land to provide an intelligible, legible and practical base map over which smaller spots could be named, described and used for observation. Selenographers in the mid-seventeenth century did not overtly argue that the Earth–Moon analogy was a cosmological truth. Instead, this simile, with multiple possible readings, helped them make allusions and convey their own personal and collective agendas.

An instrument for longitude and peace

In May 1645 a detailed graphic of the Moon based on telescopic study came out of a Brussels printing press with the title *Plenilunii Lumina Austriaca Philippica* (Austrian–Philippine Luminaries of the Full Moon). It was a presented by its maker, Michael van Langren, the royal cosmographer of Brussels, as an instrument for observation: each prominent point indicated on thedisc was named so that the visual referents could be used for the determination of longitude. This device was surrounded by citations from Cicero, Seneca, Pliny and Achilles Tatius, all of which alluded to the terrestrial nature of the Moon.

Through its title and framing with classical quotes, the selenography turned a natural-philosophical hypothesis into a political conceit: the Earth-like Moon, like a mirror, reflected the light of Philippe IV (1605–65), head of the Spanish Monarchy. For this reason, Van Langren's invention has frequently been understood reductively as a cosmographer's strategy for obtaining patronage during the decline of the Spanish Empire.[24] But this reading and its general historiographical assumptions should be given greater nuance. The selenography's making and publication process reveal that this technological innovation was not merely a scheme of imperial propaganda: it wasn't commissioned or rewarded by the Spanish Monarchy. Moreover, though the selenography did seek royal validation, it did so conveying the claims of Spanish subjects from an imperial periphery. It was a multilayered conceit that addressed inter-confessional audiences invested in the politics of technology, knowledge circulation and statecraft.

The *topos* of 'empire conquering the heavens' prevailed in the rhetoric of the Spanish Monarchy, to which Van Langren was under obligation. Offering the lights of the full Moon to Philip IV echoed the motto *non orbis sufficit* (the world is not enough) that had featured in Habsburg pageantry from the sixteenth century.[25] Such rhetorical devices, moreover, had long been appealing to celestial mapping endeavours promoted by both Catholic and Protestant mathematicians and natural philosophers. In the Counter-Reformation world, the Dominican friar Tomaso Campanella advised Philip III to send astrologers to discover the stars of the southern hemisphere, to describe – and implicitly re-establish the authority of – the figure of the Holy Cross at the Antarctic pole, and to place monuments of the emperor and the House of Austria in the sky so that 'astrology and local memory will be learnt together'.[26]

[24] Whitaker, op. cit. (3), pp. 37–46; Scott Montgomery, *The Moon and Western Imagination*, Tucson: University of Arizona Press, 1999, pp. 157–66.

[25] Thomas Haddad, 'Um imperio de outro mundo: a Lua dos Áustrias e a Luna dos astrônomos', in H.M. Gesteira, L.M. Carolino and P. Marinho (eds.), *Formas do Império: Ciência, tecnologia e política em Portugal e no Brasil: Séculos XVI ao XIX*, Rio de Janeiro: Civilização Brasileira, 2014, pp. 121–40, 121.

[26] Tomaso Campanella, *De Monarchia Hispanica*, Amstelodami: Elzevir, 1641, p. 66: 'In Mundum Novum doctos astrologos amandet … mittareque in Mundum Novum, ut ibi stellas novas orbis antartici usque ad Tropicum capricorni delineent, sacramque Crucem in polo depingant et in puncto effigies Caroli V & aliorum Austriacae domus procerum sistant, ad exemplum Graecorum & Aegyptiorum, qui principium & heroum suorum imagines eo collocarunt. Nam sic pariter Astrologia cum memoria locali discitur & cum illustres viri cum veneratione sublimantur, & tales astrologi lautis beneficiis honorantur, id non parvo argumento est regno: nam universus mundus ad talem principem vertetur cum desiderio illi serviendi.' Thank you to Pietro D. Omodeo for this reference.

Creating 'monuments' or spaces of memory in the sky was also a rhetorical strategy in the mid-seventeenth-century Netherlandish mathematical culture. In 1642, the Capuchin Anton Maria Schyrleus de Rheita, also a selenographer, claimed to have found five new satellites of Jupiter and named them *stellas urbanoctavianas* in honour of Pope Urban VIII. In reponse, Johannes Hevelius, the above-mentioned Protestant astronomer from Gdańsk, countered that those bright cosmic bodies would have better been named *Vladislavianas*, alluding to his king, Vladislao IV.[27] Back in the Southern Netherlands, the Jesuit mathematician Charles Malapert dedicated his *Austriaca sidera heliocyclia* to Philip IV of Spain.[28] Van Langren's selenography thus rephrased the conceit associating the celestial splendour of the House of Austria with a lunar technique that would allegedly help improve the map of its empire: the luminaries of the full moon referred both to the illustrious subjects of the king of Spain and to the visible spots of the satellite that were useful for telescopic observation (Figure 1).

Van Langren had been developing his selenography since at least 1621. His work was embedded in the context of the ongoing research pursuits for improving longitude methods in the Iberian world.[29] According to his own account in a pamphlet published in Antwerp in 1644, his patron, Isabella Clara Eugenia, Archduchess of Austria and regent of Belgium (1566–1633), made lunar observations with him in the court of Brussels and took great interest in his method for the determination of longitude in 1625. With her support, Van Langren received the title of royal cosmographer of Belgium and was sent to the Royal Palace in Madrid in 1631. In the Spanish court he presented two of his longitude inventions to Philip IV, who agreed to name the most prominent spots of the Moon after the 'luminaries' of his reign.[30] The Council of Indies promised a reward of four thousand ducats. However, after the archduchess's decease, by royal orders, Van Langren was obliged to return to the Flemish territory in 1634 without his reward.[31]

Eleven years later, in Brussels, Van Langren finally secured the support he needed to publish his invention. With a petition to the city's Privy Council, he submitted a manuscript model which showed what the finished map would look like.[32] An annotation in this document indicated, 'Each mountain and island, which are needed for these astronomical and geographical observations, will bear the name of a renowned person of this art and profession, one for each nation.'[33] In his official request, Van Langren asked that the naming scheme outlined in his prototype be approved so that it would not be altered in subsequent editions.

[27] Antonius Maria Schyrleus de Rheita, *Nova Stellae circa Iovem, circa Saturnum sex, circa Martem non-nullae*, Lovanii: Typis Andree Bouvetii, 1643, pp. 6; Hevelius, op. cit. (16), pp. 49–66, esp. p. 63.

[28] Charles Malapert, *Austriaca sidera astronomicis hypothesibus illigata*, Duaci: ex officinia Baltarazaris Belleri, 1633.

[29] Maria Portuondo, 'Lunar eclipses, longitude and the New World', *Journal for the History of Astronomy* (2009) 40, pp. 249–76; José María Moreno Madrid and Henrique Leitão, *A Longitude Do Mundo: Viagens Oceânicas, Cosmografia Matemática e a Construção de Uma Terra Global*, Lisbon: Imprensa Nacional – Casa da Moeda, 2024; Moreno Madrid, 'Los Pilotos Siempre Ganan: Una Historia Socio-Epistémica de La Navegación En La Europa de Edad Moderna', PhD thesis, Universidade de Lisboa, 2024.

[30] Michael van Langren, *La Verdadera Longitud por mar y Tierra*, [Brussels?]: [s.n.], 1644. See also Giovanni Battista Riccioli, *Geographiae et Hydrographiae reformatae*, Venetiis: Typis Ioannis La Nou, 1672, pp. 314–15.

[31] Michael van Langren, *Memorial de Miguel Florencio Van Langren*, Archivo General de Indias, Patronato, 262, R.7; Henri Lonchay Lemaire and Joseph Cuvelier, *Correspondance de la Cour d'Espagne sur les affaires des Pays-Bas au XVIIe siècle, Précis de la Correspondance de Philippe IV avec l'infante Isabelle (1621–1633)*, Brussels: Libraire Kiessling et P. Imbreghts, 1927, pp. 448, 567, 585, 681, 689.

[32] Michael van Langren, *Luna vel Lumina Austriaca Philippica*, Brussels, Archives Générales du Royaume, Cartes et Plans, T 459-7911; M. Prinz, 'L'original de la première carte lunaire de Van Langren', *Ciel et terre* (1903) 24, pp. 99–105.

[33] Van Langren, op. cit. (32): 'Chaque montagne et isle aura le nom de quelque personne de nomme en cet [art] et professi ... un de toute [les] nations lesquelles il a besiong en ses observations astronomiques y Geographiques.'

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Figure 1. Michael van Langren, *Plenilunii Lumina Austriaca Philippica*, Brussels: s.n., 1645, Leiden University Libraries, COLLBN 505-10-003, available at https://digitalcollections.universiteitleiden.nl/view/item/2137526.

The petition was sent to two censors, Erycius Puteanus (1574–1646) and Godevert Wendelen (1580–1667). The former, a prolific humanist and active correspondent in the Netherlandish Republic of Letters, was the successor of Justus Lipsius (1547–1606) as chair of Latin in the Collegium Trilingue of Louvain and the founder of Palaestra Bonae Mentis, a private tutoring space for students from different parts of Europe pursuing careers as civil servants. The latter was one of the most accomplished and renowned mathematicians, astronomers and chronologers in the Southern Netherlands. Both examiners were acquainted with Van Langren's work and all three had all had been invested in longitude controversies since the 1630s.[34]

From February to May 1645, when the selenography was finally published, Puteanus provided advice concerning the Latin texts surrounding the Moon, the printed sheet's layout and the completion of the lunar nomenclature.[35] Ultimately, the naming scheme that would be crucial to observation and notation embodied the decisions that were taken through this process of collaboration. Puteanus's involvement in the project inspired him to give a lecture in Louvain in early March 1645, in which he announced the upcoming selenography and discussed the Moon's ancient names. He also expounded on past understandings of the satellite's elementary composition. Lucian's fantasies, he joked in his report to Van Langren, were not entirely unlikely. He was referring to the renowned Menippean satire that used an imaginary journey to the Moon as a vehicle through which to critique earthly politics and poke fun at terrestrial philosophers.[36] In another letter, he suggested to Van Langren that they should assign a spot on the lunar surface to those ancient philosophers who defended the Earth–Moon analogy. In the final phase of the map's production, Van Langren anounced that he had decided to name the spaces distinguishing land with the word *terra* (referring here to both land in general and to Earth as a planet) instead of *regio* (region). Puteanus expressed his approval, underscoring that *terra* would indeed emphasize that the Moon was an Earth.[37]

Counter-Reformation natural philosophers tended to dissociate telescopic descriptions of the Moon from hypotheses about the satellite's earthly nature. For example, in the context of Jesuit mathematics, Christoph Clavius, François d'Aguilon (1577–1617), Christoph Scheiner (1573–1650) and Giuseppe Biancani (1566–1624) all made telescopic observations, accepted that the irregularities on the lunar surface were visible, and agreed that the Moon was not a perfect sphere. Nonetheless, they continued to defend the position that the lunar substance was quintessential, incorruptible and thus fundamentally different from the Earth's.[38] Notably, however, this opinion was not unanimously held by Catholic scholars. Discussions of the Earth–Moon analogy, and of the corruptibility of the heavens more widely, echoed across printed texts and epistolary correspondence in places such as the Southern Netherlands. For instance, the above-mentioned Jesuit Charles Malapert declared that the Moon, Venus and Mercury were each of an earthly substance.[39] This type of claim was linked to questions regarding the mobility of the Earth, which were openly, although carefully, discussed in Van Langren's circle of courtly and university correspondents. As Vanden Broecke has demonstrated, Wendelen, the second censor of the manuscript proof submitted to the Privy Council, was an open proponent of a geo-dynamic cosmos in public spheres as well as in his epistolary correspondence, albeit without going so far as to assert this opinion in print.

[34] Haddad, op. cit. (1), pp. 27–30; Richard de Grijs, 'European longitude prizes: astronomy, religion, and engineering solutions in the Dutch Republic', *Journal of Astronomical History and Heritage* (2021) 24(2), pp. 405–39.

[35] Erycius Puteanus, *Honderd veertien Nederlandse brieven van Erycius Puteanus aan de astronoom Michael Florent van Langeren*, *Met een inleiding uitgegeven door J.J. Moreau*, Amsterdam: Antwerpen/Wereldbibliotheek, 1957; Henri Bosmans, 'La carte lunaire de van Langren conservée aux Archives générales du royaume, à Bruxelles', *Revue des questions scientifiques* (1903) 4, pp. 106–39, 148–9. Thank you to Cesar Manrique, Steven Gooseens and Martijn Stroms for their invaluable help with Dutch translations.

[36] Puteanus, op. cit. (35), pp. 155: 'Lucianus niet geheel fabulent en is.' Tabitta van Nouhuys, *The Age of Two-Faced Janus: The Comets of 1577 and 1618 and the Decline of the Aristotelian World View in the Netherlands*, Leiden, Boston and Cologne: Brill, 1998, pp. 303–21.

[37] Puteanus, op. cit. (35), pp. 152, 161–2.

[38] Pantin, op. cit. (21), pp. 103–20.

[39] Malapert, op. cit. (28), p. 13; also in Wilkins, op. cit. (22), pp. 73–4.

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His natural-philosophical commitments were known to Puteanus.[40] The humanist in Louvain may have embraced a similar opinion, and through Puteanus this discussion would have been known to Van Langren.

However, although the Earth–Moon analogy could be read as an argument in favour of a heliocentric world system, Van Langren's selenography was not a public pronouncement in favour of that cosmology. Here, the Earth–Moon analogy perhaps more explicitly played into debates concerning the corruptibility of the heavens, an argument that was relevant to Neo-Stoic frameworks. Such Neo-Stoic associations resonated widely in the Spanish Netherlands as a privileged context for natural philosophy in its connections with religion and morality.[41]

Both censors of Van Langren's selenography, Wendelen and Puteanus, were engaged in studying and adapting this philosophy to the social order of the Spanish Netherlands.[42] Puteanus, particularly, was personally committed to publicly defending the Neo-Stoic philosophy of his mentor and predecessor Justus Lipsius. In the collection of orations that represented the pedagogy of his Palaestra Bonae Mentis, students were invited to adopt the Neo-Stoic ethics of concord, temperance and peaceful human action in their future political offices.[43] Van Langren, in turn, came from a lineage of renowned Dutch printers, globe-makers and map-makers. His father was a skilled map and globe engraver who, among many other works, corrected maps for Balthasar Moretus's revision of Abraham Ortelius's *Theatrum Orbis Terrarum*. Thus, trained through this family apprenticeship, Michael van Langren was well acquainted with the Neo-Stoic discourse that bridged morality and nature through the mapping tradition of Gerard Mercator, Abraham Ortelius and Franz Hogenberg. From this perspective, maps were represented as spaces for contemplation of temperate and righteous world ideals.[44] In this context, the Earth–Moon analogy acquired broader connotations that were not openly or necessarily committed to argumentative claims concerning the Earth's mobility.

The Earth–Moon analogy that supported this lunar nomenclature was used by Van Langren and Puteanus as a scholarly exercise that would give moral and political import to a mathematical instrument. The Neo-Stoic discourse was conveyed through the names attached to the lunar areas that were not 'seas'. Puteanus convinced Van Langren to name the regions considered 'land' as spaces of virtue and suggested Terra Honoris, Terra Virtutis, Terra Scientiae, Terra Laboris, and Terra Pacis.[45] This philosophy was further reinforced by the placements of the classical citations that surrounded the selenography, and most explicitly through the famous excerpt associated with Stoicism from Book VII of

[40] Steven vanden Broecke, 'How to be a Copernican in the Spanish Netherlands', in Andreea Badea, Bruno Boute, Marco Cavarzere and Steven vanden Broecke (eds.), *Making Truth in Early Modern Catholicism*, Amsterdam: Amsterdam University Press, 2021, pp. 85–110, 91–2.

[41] Isabelle Pantin, 'Libert Froidmont's conception and imagination of space in three early works: *Peregrinatio coelestis* (1616), *De cometa* (1618), *Meteorologica* (1627)', in Frederik A. Bakker, Delphine Bellis and Carla Rita Palmerino (eds.), *Space, Imagination and the Cosmos from Antiquity to the Early Modern Period*, *Studies in History and Philosophy of Science* (2018) 48, pp. 179–99.

[42] Steven vanden Broecke, 'Eschatology, divination, and Gassendi's encounter with Spanish-Netherlandish natural philosophy', *Erudition and the Republic of Letters* (2023) 8, pp. 336–56, 435.

[43] Jan Papy, 'In praise of the omnipresent egg: Erycius Puteanus' Ovi Encomium (1615)', in Dirk Sacré *et al.*, *Acta Puteana: Proceedings of the International Colloquium Erycius Puteanus (1574–1646)*, *Humanistica Lovaniensia Journal of Neolatin Studies* (2000) 49, pp. 317–38, 319–20; Erycius Puteanus, *Suada Attica sive orationum selectarum syntagma: item Palestra Bonae Mentis, prorus innovata*, Amstelodami: Iodocum Ianssonium, 1647, [$*4v] 176–96, 219–67.

[44] Pieter van der Krogt, *Globi Neerlandici: The Production of Globes in the Low Countries*, Utrecht: HES, 1993, pp. 259–60; Giorgio Mangani, 'Abraham Ortelius and the hermetic meaning of the cordiform projection', *Imago Mundi* (1998) 50, pp. 59–83, pp. 60, 71; Chet van Duzer, *Frames That Speak: Cartouches on Early Modern Maps*, Leiden: Brill, 2023, pp. 59–63.

[45] Puteanus, op. cit. (35), p. 147, 152.

Seneca's *Natural Questions* announcing, 'The time will come when careful study over long periods will bring to light things which now lie hidden', set at the bottom right of the lunar disc.[46] In the printed broadsheet, the viewer of the map would read such quotation right below 'Terra Pacis'. This visual strategy strengthened associations between the astronomical instrument and its political time.

In 1645, when *Pleniluna Lumina Austriaca Philippica* came off the printing press, peace was a pressing political issue in the context of the wars between the Spanish Monarchy and the Dutch Republic.[47] Puteanus had long advocated for a truce in his pamphlet *Statera pacis et belli*, later included in *Dissertationes de induciis belli Belgici*, both published in Leiden in 1633.[48] The selenography, published more than ten years later, can be read as a continuation of his plea for peace. On this occasion, the argument was made visually, through a rare image that was also an instrument for scientific observation and communication.

Through its nomenclature, the selenography conveyed ideals around which its potential users and collectors, and even critics, could coalesce in the context of violent religious upheavals. Conveying Neo-Stoic philosophy through the names of lunar locations turned a technical necessity (giving memorable identifiers to observation and notation spots used for observation) into a rhetorical conceit integral to a commentary about Netherlandish and European politics around 1645. About 50 per cent of the names inscribed in the selenography evoked a complex political network of Italian dukes; electors of the Holy Roman Empire; and French, Danish and Polish sovereigns and diplomats who participated directly or indirectly in the peace negotiations to end the Thirty Years War, which coincided with the timing of the map's publication. Consider, for instance, the spots bearing names of the ambassadors who met in Münster and Osnabrück: Count Maximilian Trauttmansdorff from Austria, Johan Oxenstierna (1611–57) from Sweden, Gaspar de Bracamonte Guzman (1595–1676) from Spain, Henri de Valois–Longueville (1595–1663) from France, Isaak Volmar (1582–1662) from the Austrian imperial delegations, Fabio Chigi (1599–1667), the papal legate who became Pope Alexander VII, and Alvise Contarini (1601–84) of Venice. Placing these names, as well as those of the Catholic Italian princes, alongside the Protestant electors was Puteanus's design.[49] In this way, the naming strategy for purportedly universal astronomical observation and notation also created a communication instrument about and for local politics.

Names of mathematicians and natural philosophers embedded in the religious and political turmoil were also clustered across the disc. Some were grouped through regional identity or political association: Dutch scholars such as Guerrit Janszoon Voss (1577–1649), Caspar van Baarle (1584–1648), Daniel Heins (1580–1655) and Constantyn Huygens were acknowledged in Terra Sapientiae; Puteanus, Jean della Faille (1597–1652) and Govaert were located in Terra Temperantiae around the large macula on the left side of the Moon. The spots containing Dutch humanists were scattered around Mare Eugenianum (after Van Langren's patron), Mare Belgicum and Sinus Batavicus (the Latin toponym for the Netherlands), creating a visual allegory of an undivided Northern and Southern Netherlands. Patronage on a local scale was also significant: a small circle touching the edge of that region referred to the patron who facilitated this publication – Manuel de Moura y Cortereal (1590–1651), governor of the Spanish

[46] Quoted in the broadsheet is 'Seneca Nat. Quest. Lib. VII. Multae hodie sunt gentes, quae tantum facie noverint caelum; quae nondum sciant cur Luna deficiat, quare adumbretur. Veniet tempus, quo ista, quae nunc latent, in lucem extrahat, et longioris aevi diligentia. Venit tempus, quo posteri nostri tam aperta nos nescisse mirentur'. Van Langren, op. cit. (4).

[47] Derek Croxton, *Westphalia: The Last Christian Peace*, New York: Palgrave Macmillan, 2013, pp. 89–187.

[48] Erycius Puteanus, *Belli et Pacis Statera: A Iusti Lipsi Manibus In Elysio Adaequata*, Lugduni Batavorum: s.n., 1633, p. 23; Puteanus, *Dissertationes de induciis belli Belgici*, Lugduni Batavorum: Ex Officina Elzeviriorum, 1633.

[49] Puteanus, op. cit. (35), pp. 152, 154, 161, 163.

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Netherlands from 1644 to 1647 and a key figure in the early Münster peace negotiations. The spot given to this patron was an important reference point in lunar observation practices.

In this way, the nomenclature was a technical and rhetorical instrument that could ostensibly speak directly to its audience. It invited the reader to engage in the visual games of seeing who was located where and why. Some names were clustered by nationality or occupation, but this was not a rule of thumb. Ambiguity was used to arouse curiosity in the reader. Puteanus's letters to Van Langren do not suggest that this purposefully loose criterion was considered an obstacle to making a reliable notation and observation scheme.

Puteanus's investment in local politics and pedagogy reveals some crucial decisions in the establishment of the nomenclature. He did not hide his motivations from Van Langren: one of his sons, Andreas, was an army officer who wanted to be promoted to captain in the division of Octavio Piccolomini, Duke of Amalfi and commander of the Spanish forces in the Netherlands. Thus he asked Van Langren if the name of his illustrious son could be inscribed south of Sinus Batavicus. In another letter, he informed the cosmographer that there was a distinguished diplomat who had participated in the Italian peace treaties, in the papal conclave of 1644, and was strategically located in the papal court of Innocent X. Such gentleman was willing to be the primary distributor of the map in Rome and – as it transpired towards the end of the note – was also his son-in-law. He also asked for a spot to be named after an alumnus of his Palaestra, Jerzy Ossoliøski (1595–1650), who was Great Crown Chancellor of the Kingdom of Poland.[50] The spot 'Ossolinski' was ultimately inscribed in Terra Iustitiae. Beyond these circumstantial requests that reveal Puteanus's investment in affairs ranging from the papal conclave to the peace negotiations for the Eighty and Thirty Years Wars, the lunar nomenclature was an ingenious strategy for displaying political relations across ecclesiastic, civil and scholarly spheres in Louvain and the courts of Brussels, and beyond. Many names legible on the Moon map also featured in Puteanus's published correspondence collected in *Epistolarum Apparatus*.[51] Sociability was built into the selenography because gaining social credit would help secure its reception amongst potential users, collectors and patrons.

Beyond the turmoil of European politics, Van Langren and Puteanus also aspired to reach high ecclesiastics and missionaries around the world through their connections with the Society of Jesus, the clearest institutionally identifiable group in the lunar map.[52] To engage this audience they emphasized the selenography's function as a unique instrument for a new method for the calculation of longitude that could be useful to apostolic missions. The plan was that missionaries would carry out observations of lunar eclipses with the selenography and Van Langren's instructions. They would send their results back to the cosmographer major of the Council of Indies and he, in turn, would convey the observations to Van Langren.[53]

Well-placed intermediaries such Jean della Faille, an Antwerpian professor of mathematics at the Imperial College in Madrid and cosmographer major of the Council of Indies,

[50] Puteanus, op. cit. (35), p. 157–9; For Puteanus: Theophile Simar, *Étude sur Erycius Puteanus, 1574–1646*, Louvain: Presses universitaires de Louvain, 1909; Andrea Borowski, 'Erycius Puteanus and the Polish literary culture of the 17th century', in Sacré *et al.*, op. cit. (43), pp. 193–200.

[51] Puteanus, *Epistolarum selectarum apparatus*, Amstelodami: Jodocum Janssonium, 1646, pp. 108–11.

[52] In the third edition of the *Plenilunii*, printed in 1670, the names of six Jesuit mathematicians were added to the nomenclature. Michael van Langren, *Selenographia Langreniana sive Lumina Austriaca Philippica*, [Brussels: n.a.], 1670. An inventory of names in all the editions of Van Langren's map is in Van der Krögt and Ormeling, op. cit. (7).

[53] Jean della Faille to Michael van Langren, 18 May 1639, in Omar van de Vyver, 'Lettres de J.Ch. della Faille, S.I., cosmographe du roi à Madrid, à M.F. Van Langren, cosmographe du roi à Bruxelles', *Archivum Historicum Societatis Iesu* (1977) 46, pp. 73–183, 181. The holograph letters are held in KNB Ms 19837–8.

helped conceive this plan. Della Faille had collaborated with Van Langren in longitude research since the 1630s, so in 1645 he spread news of the publication. Notably, he announced Van Langren's invention to the papal nuncio in Spain. The diplomat was delighted, wrote della Faille to Van Langren, and offered to send the instructions for calculating longitude with the selenography throughout the world. Using the circuits of Jesuit bureaucracy for this distribution would drastically reduce the costs of dissemination. Additionally, the Jesuit underscored, it would be possible to use the upcoming papal election in Rome as an opportunity to distribute the paper moons amongst Jesuit procurers (delegated mission administrators) across the West Indies.[54] Van Langren and Puteanus wanted the nomenclature to be ecumenical and, at the same time, targeted these particular audiences in Catholic circuits to secure its wide distribution amongst other colonial instruments of confession.

As this shows, lunar nomenclature was an observation and notation scheme that was made to speak to its desired users, collectors and channels of distribution. It was designed with the aspiration of pleasing a wide range of audiences, so that it could be accepted and used for collective observation. At the same time, it also materialized personal and local interests. Heavily rhetorical, it was an encoded allegory: both a plea for inter-confessional peace and a mathematical instrument for religious colonization that would further the prestige of its makers.

A lunar observation language for the legitimation of astronomy

In 1651, six years after Van Langren's map was published, Giambattista Riccioli published the *Almagestum Novum*.[55] This work was part of an ongoing Counter-Reformation project to produce Catholic encyclopedias of ancient and modern knowledge, such as Antonio Possevino's *Bibliotheca Selecta*. Both Riccioli's and Possevino's scholarship emphasized the significance of the mathematical sciences as tools for theology.[56]

Riccioli, who focused on astronomy, would update the *Epitoma in Almagesti Ptolomei* (Epitome of Ptolemy's Almagest), completed by Regiomontanus (1436–76) and published in Venice in 1496.[57] It would also provide a modernized alternative to the most esteemed seventeenth-century annotated edition of Sacrobosco's *Sphere* (the reduced Latin version of Ptolemy's *Almagest* used as a textbook in universities from the thirteenth century) produced in the Catholic world by the Jesuit Christoph Clavius.[58] Within the vast body of knowledge that Riccioli sought to represent in his ambitious compilation, the Moon had a central role: it was the unruly luminary which, adequately described, would yield better data for measuring the cosmos and correcting chronology.[59] Producing a more accurate selenography would provide astronomers with a powerful tool for better observations and informed theory.

By the time the work was published, Riccioli had taught logic, physics and metaphysics in the College of Santa Lucia in Bologna for fifteen years. References to the process of producing the *Almagestum Novum* are found in his correspondence with a censor of the

54 Van de Vyver, op. cit. (6), p. 180.

55 Riccioli, op. cit. (5).

56 Antonio Possevino, *Bibliotheca selecta de Ratione Studiorum*, Venetiis: Apud Altobellum Salicatium, 1593. Volker R. Remmert, '"Our mathematicians have learned and verified this": Jesuits, biblical exegesis, and mathematical sciences in the late sixteenth and early seventeenth centuries', in Scott Mandelbrote and Jitse M. Meer (eds.), *Nature and Scripture in the Abrahamic Religions*, Leiden: Brill, 2008, pp. 666–90.

57 Joannes Regiomontanus, *Epytoma Joa[n]nis de Mo[n]te Regio in Almagestu[m]*, Ptolomei, Venetiis: Impensis … Casparis Grossch; Stephani Koemer, 1496.

58 Christoph Clavius, *In Sphaeram Ioannis de Sacro Bosco commentarius* in *Operum Mathematicorum*, vol. 3, Moguntiae: Sumptibus Antonii Hierat Excudebat Reinhardus Eltz, 1611–12, See also Lattis, op. cit. (21), pp. 37–44.

59 Riccioli, op. cit. (5), pp. xvi.

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Collegio Romano, written most likely in December of 1646.[60] Riccioli was asked to submit a section of the book detailing his own inventions (*quam de propiis inventiis inscribit*).[61] Censors wanted to know if he would add anything new to eminent masters (*artifices*) such as Tycho, Kepler and Lansberg. They also wanted to know precisely which instruments and methods Riccioli used in his astronomical observations of the motion of heavenly bodies. The censor's requests did not imply an institutional condemnation of the works of Protestant astronomers but instead reflected a complex process of regulation practices to control printing within mid-seventeenth-century Jesuit bureaucracy.[62] Riccioli replied in detail. He assured his censor that it was not his intention to put forward his own inventions, but to revise all existing astronomical knowledge through instrumental practices in order to reconcile what could be reconciled, and to assess what could not, providing clear criteria on either side to justify the position and ensure that anyone could follow their preferred hypothesis.[63]

Riccioli's reply to the censor's examination is, in a nutshell, the ethos of both the *New Almagest* and his new selenography. Like every other chapter of the volume, his selenography was driven by a spirit of collection, revision, correction and synthesis. It was presented in Book 4, dedicated to the Moon, following the order of Ptolemy's *Almagest*, as an instrument made to improve the quality of lunar libration observations. First, the Jesuit aimed to evaluate all available studies on the nature and motion of the satellite (Figure 2).[64] Following arguments by Christoph Clavius, Christoph Scheiner and François d'Aguilon, he concluded that, though the Moon did receive reflected light from the Sun (like the Earth), the satellite was nonetheless made of celestial, incorruptible matter. Thus he denied Earth–Moon analogy and disassociated his work from theological controversies on the matter.[65] This attitude was further reinforced by a verbal statement inscribed at the heading of his new selenography: 'Nec homines lunam incolunt. Nec Animae in Lunam migrant' ('Men do not inhabit the Moon; souls do not migrate to the Moon').

Francesco Maria Grimaldi (1618–1663), who studied with Riccioli in the Jesuit colleges of Parma and Santa Lucia and eventually became his closest collaborator, carried out the technical endeavour of comparing observations made through different telescopes and with the best available printed selenographies (Figure 3).[66] Riccioli and Grimaldi were

[60] Ivana Gambaro, *Astronomia e tecniche di ricerca nelle lettere di G.B. Riccioli ad A. Kircher*, Genoa: Centro di studio sulla storia della tecnica del Consiglio nazionale delle richerche, 1989.

[61] 'Desideratur a P.J. Baptista Ricciolo, ut Roman mittat eam operis sui partem, quam de propriis inventis inscribit, ut primo cognoscatur, qui post tot eximios artifices Tychonem, Keplerum, Lansberguim … novi praestiterit. Quibus instrumentis et qua metodo in observandis syderum motibus usus est.' Transcribed in Gambaro, op. cit. (60), p. 40.

[62] John L. Heilbron, *The Sun in the Church*, Cambridge, MA and London: Harvard University Press, 1999, pp. 87; Michael J. Gorman, *The Scientific Counter-Revolution: The Jesuits and the Invention of Modern Science*, London: Bloomsbury Academic, 2020, pp. 2, 44, 89–91, 184–5; Christoph Sander, 'Uniformitas et soliditas doctrinae: history, topics, and impact of Jesuit censorship in Philosophy (1550–1599)', in Cristiano Casalini (ed.), *Jesuit Philosophy on the Eve of Modernity*, Boston: Brill, 2005, pp. 34–71.

[63] Gambaro, op. cit. (60), pp. 70–6: 'Meum porro consilium fuit non damnare aut antiquare Astronomiam Tychonis, Longomontani, Kepleri, Lansbergii, Bullialdi, Vvendelini, et similium, sed ex his et omnibus qui quoquemodo Astronomica attingerunt unum opus conflare in quo artis fundamenta usque ad prima principia patescerent, conciliare quae conciliari possent, quae vero non possent expendere, allatis utrinque rationibus, ut unusquisque quas mallet sequeretur hypotheses, certa interim a probabilibus discernendo, et aequationes mottum, quibus tabulae unius Astronomi ad aliorum tabulas redegi possent, suppeditando quo facilius examinari deinceps et ad coelestia phenomena conferri possent.' Dinis, op. cit. (6), p. 205.

[64] Riccioli, op. cit. (5), pp. 186–7.

[65] Riccioli, op. cit. (5), p. 187. For the Moon's reflected light see Riccioli, op. cit. (5), pp. 197–201; Pantin, op. cit. (21), p. 109.

[66] Riccioli, op. cit. (5), p. 204.

Figure 2. 'Figura pronomenclatura libratione lunari', in Giovanni Battista Riccioli, *Almagestum Novum*, Bologna, 1651, between pp. 204 and 205. Courtesy of Linda Hall Library of Science, Engineering & Technology. Available at https://catalog.lindahall.org/discovery/delivery/01LINDAHALL_INST:LHL/12100908460005961.

concerned with consensus: they wanted their readers to know that their selenography was made through a process of collection, comparison, synthesis and revision with every telescope and selenography that they could procure. The fold-out engraving that presents their project communicated their methodology to their audience. The heading reads

> Selenographia by the father of the Society of Jesus Maria Francesco made using an excellent telescope, selected from various lunar phases, in which he partly confirmed the selenographies of Langren, Hevelius, Eustacio, Sirsalis, etc., and partly corrected, and augmented them, so that even the smallest features in some phases could be shown'.[67]

[67] Riccioli, op. cit. (5), plate inserted after p. 204: 'Selenographia P. Francisci Mariae Grimaldi Soc. Iesu Optimo Telescopio ex pluribus Lunae phasibus selecta, in qua Langreni, Hevelii, Eustachii, Sirsalis, etc. Selenographia partim firmavit, partim ita correxit, et auxit, ut vel minimæ particulæ ex aliquibus phasibus evidentiam sit assecutus'.

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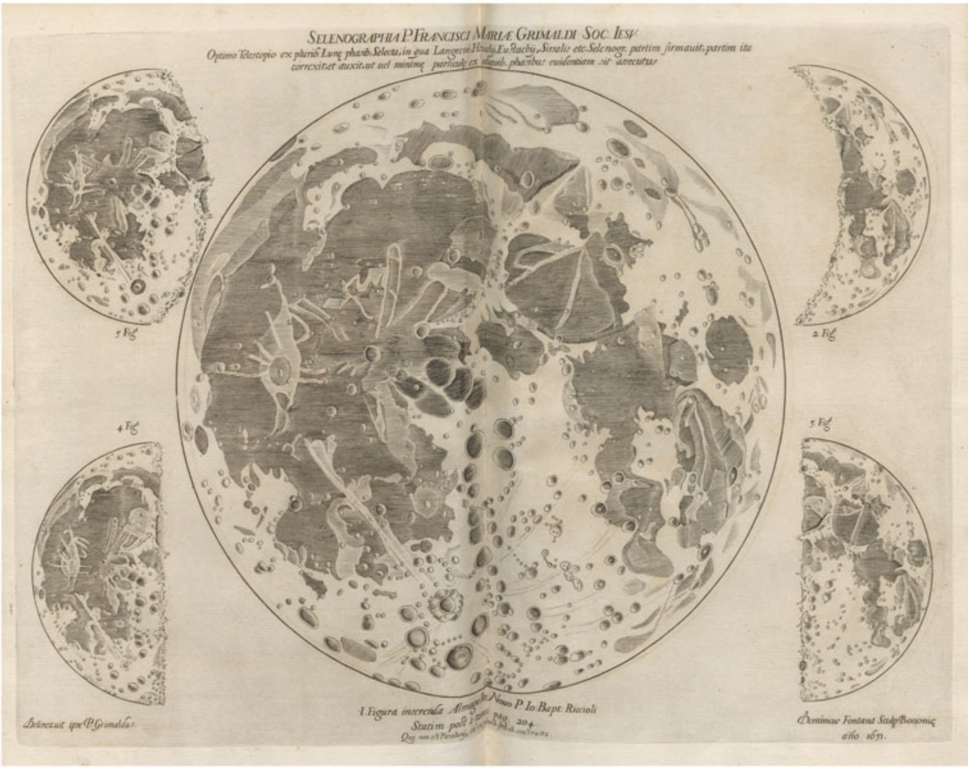

Figure 3. 'Selenographia P. Francisci Mariae Grimaldi Soc. Iesu' in Riccioli, *Almagestum Novum*, op. cit., between pp. 204 and 205. Courtesy of Linda Hall Library of Science, Engineering & Technology.

The new selenography was both an original conceit and a highly synthetically encoded tool. In it, Riccioli and Grimaldi presented a nomenclature that acknowledged but did not reproduce the schemes of their predecessors. They used geographical terminology to generally classify lunar regions as oceans, seas, islands, land and so on, but noted the Earth–Moon analogy's problematic relation to exegesis. Though they kept some names from Van Langren's nomenclature, they did not develop their system based on patrons or prominent members of the Republic of Letters. Instead, they erected their nomenclature upon their medical–astrological and astronomical tradition, and included names of scholars whose work informed the *Almagestum Novum*.[68]

Riccioli and Grimaldi examined the rhetorical possibilities that the selenography and its nomenclature could offer to its users. They resorted to mnemotechnical strategies of spatially organizing and visualizing clusters that related thematically. First, in order to function as an observational instrument, the circle was divided in into octants so that the main

[68] Riccioli, op. cit. (5), p. 204: 'Nomenclatura porro Lunarium partium non ex telluris nostrae geographia, ut fecit Hevelius, ob defectum analogiam indicatum, desumpsi: sed a personis potius, non cuiusius conditionis, ne promiscue, aut quasi casu distributis, ut cernere est in Langreni plenilunio, sed ex iis tantum, qui vel Astronomi fuere potius quam Astrologi Genethliaci, vel ex quorum scriptis antiquoribus aliqua eruditio Astronomica in Almagestum nostrum derivata est. Profitemur tamen, nos ab eorum errore prorsus abhorrere, qui finxerunt, aut Lunam ab aliis hominibus incoli, aut heroum vel etiam aliorum mortalium animas post obitum in Lunae diversa receptacula, pro diversis meritis transmigrare.'

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planetary configurations (conjunctions, oppositions and syzygies) could be easily recorded diagrammatically over the circle. Second, the largest divisions between bright and shaded spaces of the lunar disc were outlined to contain key observational spots – as with other contemporary selenographies. Then, those particular spots were further crafted to function as parts of a diagrammatic mnemotechnic device with referents to the history of astronomy. The establishment and distribution of the lunar nomenclature was likely inspired by the circular diagrams produced within the tradition of Isidore of Seville's *De Natura Rerum*. These figures, which were used and reappropriated widely from late antiquity to early modernity, served to organize, sometimes by dividing and classifying, elements of different doctrines or ideas in order to reveal their contradictions.[69]

Instead of using the Moon to convey cosmological possibilities and political ideals, as in Van Langren's map, Riccioli and Grimaldi projected lunar scholarship. They drew the basis of their naming system from classical and medieval medico-astrological traditions, through which the closest celestial body to Earth was understood as an agent that affected meteorology, behaviour and health. For instance, users would record observations relative to the largest dark region of the lunar disc in Oceanus Procellarum (the Sea of Storms), which was Riccioli's equivalent of Oceanus Philippicus. Surrounding this area, the nomenclature for smaller spaces conveyed a juxtaposition of medical and meteorological imagery: the Peninsula Deliriorum (Peninsula of Madness) and Peninsula Fulgorum (Peninsula of Lightning), Mare Humorum (Sea of Humours), Sinus Epidemiarum (Bay of Diseases), Mare Imbrium (Sea of Rain) and Insula Ventorum (Island of Winds). With these signifiers, the western hemisphere of the Moon conveyed decline. Negative attributes continued towards the north, with signifiers alluding to cold and death. Such connotations were counterbalanced on the eastern side of the disc with positive qualifiers such as tranquillity, fecundity and pleasantness, through Mare Serenitatis (Sea of Serenity), Mare Tranquilitatis (Sea of Tranquility), Mare Nectaris (Sea of Delight) and Mare Vigoris (Sea of Vigour). The nomenclature poetically evoked and repurposed signifiers associated with traditional lunar medicine. Those referents were known widely across universities, courts and popular culture in Europe and beyond through practice and early modern almanacs, such as those printed in Bologna from the fifteenth century.[70]

Over that surface, the Jesuit mathematicians conjured up names from a canon of scholars pertinent to the history of astronomy. Riccioli explained that, much like a diagram, the disc was divided into octants that organized *physicoastronomers* through chronological, philosophical or party (*secta*) associations.[71] The binomial *physicoastronomers* is intriguing: it is found but once in the entire text and Riccioli did not clearly explain what he implied. However, the Jesuit seemed to be proposing a reorganization of the canon in which natural philosophers (*physici*) and astronomers (here distinguished from *mathematici*, *astrologi* and *cosmographi*, as celestial observers were broadly defined in the early modern period) were blended into one and the same disciplinary classification.

Such a proposition was unusual considering the official distinctions between natural philosophy and mathematics adopted in the politics of the Counter-Reformation and

[69] For circular diagrams in the tradition of Isidore of Seville, see John E. Murdoch, *Album of Science: Antiquity and the Middle Ages*, New York, 1984, 52–61, 356–8.

[70] Riccioli, op. cit. (5), p. 204: 'Regiones autem superficies Lunaris, quae vel continentes terras, vel maria, lacus, paludesue &c. imitantur non a speciebus Matheseos, ut optabam, (id enim commodiorem minorum partium nomenclatura, impediturum erat) denominavi; sed ab ea Meteoricorum fere effectum diversitate, in quam Luna omnium maxime siderum, ob vicinam cum terra, & multiplicitatem motuum ac sui partium influere creditur.' For astrology and almanacs in Bologna see Robert Westman, *The Copernican Question: Prognostication, Skepticism, and Celestial Order*, Berkeley, Los Angeles and London: University of California Press, 2011, pp. 87–100.

[71] Riccioli, op. cit. (5), p. 204: 'Dixi me non casu praedicta nomina distribuisse in discum Lunae; siquidem in superiori circiter parte antiquiores collocavi, & in primo ac secondo fere Octante plerosque Physicoastronomos.'

Jesuit teaching. Astronomy was traditionally considered a mathematical science concerned with physical phenomena and quantity, not causes; whereas 'physics', or natural philosophy, sought to reveal causes and essential natures. In the Thomistic–Aristotelian framework, the mathematical language that supported astronomy was viewed as abstract and alienated from physical reality, bearing no relation to natural causes. Geometrical demonstration, moreover, was viewed by theologians and natural philosophers as an arbitrary construction that did not resist syllogistic reasoning. This led to a distinction of mathematics and physics in the Jesuit curriculum known as the *ratio studiorum*.[72] Yet, in the new selenography, which places natural philosophers within a scheme that alludes to astronomy's history, a new place for the celestial discipline is advanced: as Riccioli argues in the book's preface, astronomy was a tool for natural philosophy that ultimately served theology.[73]

The nomenclature's spatial organization was thus a thematic and chronological account of the history of astronomy that included natural philosophers. Named observation points followed a clockwise orientation, reading from left to right. The first and second octants clustered designated markers relating to classics such as Plato and Aristotle. In the third and fourth sections, Riccioli and Grimaldi grouped ancients such as Manilius, Vitruvius, Pliny and Macrobius, with mythological or literary characters, such as Atlas, Hercules, Hermes and Menelaus. The sixth octant represented Ptolemy, Albategni and Alphonsus, alongside sixteenth-century authors of cosmographies who elaborated on the writings of those scholars, such as Gemma Frius, Oronce Fine and Francesco Barozzio. In the fifth, sixth, seventh and eighth octants, modern astronomers with differing cosmological attitudes were scattered around. Riccioli deliberately joked that, in Oceanus Procellarum, Protestants such as 'Copernicus, Rheticus, Maestlin, Rheinhold and other of their party … swam around the islands owing to the instability of the earth that they affirmed' (Figure 4).[74]

As Protestant Copernicans were placed in a region signifying turbulence and conflict, a number of scholars have suggested that the Jesuit was either presenting a condemnation of the heliocentric world system, or insinuating his crypto-Copernicanism.[75] Yet this image was not intended to convey Riccioli's personal cosmological commitments in any explicit way. Here, Riccioli is not arguing for a particular world system (he does so explicitly in the second tome of the *Almagestum Novum*).[76] As Renée Raphael's analysis of student notebooks in Jesuit colleges has shown, heliocentrism, for instance, was taught in courses of mathematics in order to instruct students in the defence of doctrines traditionally associated with their institution.[77] This hypothesis and its proponents were discussed

[72] Peter Dear, *Experience and Discipline: The Mathematical Way in the Scientific Revolution*, Chicago: University of Chicago Press, 1995, pp. 32, 167–8; John Heilbron, *Electricity in the Seventeenth and Eighteenth Centuries: A Study of Early Modern Physics*, Berkeley: University of California Press, 1979, pp. 98–115; Antonella Romano, *La Contre-Réforme mathématique: Constitution et diffusion d'une culture mathématique jésuite à la Renaissance (1540–1640)*, Rome: École française de Rome, 1999, pp. 86–42. Lattis, op. cit. (21), pp. 30–8; Ladislaus Lukacs and Guiseppe Cosentino, *Church, Culture, & Curriculum: Theology and Mathematics in the Jesuit Ratio Studiorum* (tr. Frederick A. Homann), Philadelphia: Saint Joseph's University Press, 1999, pp. 6, 47–67.

[73] Riccioli, op. cit. (5), pp. 1–2.

[74] Riccioli, op. cit. (5), p. 204: 'Tychoni partier Gulielmum Hassiacum, Hainzelium, Safferidem, Longomontanum adposui: non secus ac Copernico suos Rheticum, Moestlinum, Reinholdum, & coeteros plerosque illius sectae, quos etiam de industria in procelloso Oceano iactari potius tanquam natantes insulas ob instabilitatem telluris ab iis assertam, quam considerare licebit, analogias non paucas afectavi.'

[75] Vertesi, op. cit. (1), p. 412; Alfredo Dinis, 'Was Riccioli a secret Copernican?', in Borgato, op. cit. (6), pp. 49–77.

[76] Flavia Marcacci, *Cieli in contraddizzione: Giovanni Battista Riccioli e il terzo sistema del mondo*, Perugia: Aguaplano, 2018.

[77] Renée Raphael, 'Copernicanism in the classroom: Jesuit natural philosophy and mathematics after 1633', *Journal for the History of Astronomy* (2015) 46(4), pp. 419–40.

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Figure 4. Detail of the protestant astronomers 'swimming' amongst the islands of Oceanus Procelarum.

in courses of mathematics, to train students to debunk the model, at the very least. The nomenclature embedded in the selenography was a means of visualizing different controversies. Designing the graphic in this way aligned with the Jesuit pedagogy outlined in the *Ratio Studiorum*, in which images (verbal, pictorial, exegetical, rhetorical, poetic, to mention examples from a wide and fluid topology) were given an educational, rhetorical and hermeneutic function.[78]

One of the main objectives of *Almagestum Novum* was 'to be a library of universal ancient and modern astronomical knowledge, including associated controversies, for the members of the Society of Jesus and others who did not possess books on those subjects or who did not have the leisure to read them'.[79] This aim was extended to, supported

[78] [Society of Jesus], *Ratio Studiorum: Plan raisonné et institution des études dans la Compagnie de Jesus: Édition bilingue latin–français* (tr. Léone Albrieux and Dolores Pralon-Julia) Paris: Bélin, 1997, p. 132; Wiets de Bower, Karl A.E. Enekel and Walter Melion (eds.) *Jesuit Image Theory*, Leiden, Boston: Brill, 2016, pp. 4–8; Catherine Bousquet-Bressolier, 'Pédagogie de l'image jésuite: De l'image emblématique spirituelle aux emblemata mathématiques', in Bousquet-Bressolier, *François de Dainville: Pionnier de l'histoire de la cartographie et de l'éducation*, Paris: Publications de l'École nationale des chartes, 2004, at http://books.openedition.org/enc/615 (accessed 20 April 2024).

[79] Riccioli, op. cit. (5), p. xviii: 'Opus astronomicum, quod nostrae Societatis viri, aliisque, qui vel multitudine librorum hujus generis, vel otio omnes perlegendi carerent, instar bibliothecae posset esse, et in quod universam Astronomiam veterem ac novam una cum controversis ad eam pertinentibus, quanta possem erudition colligerem.' Gérard Péoux, 'Almagestum novum: Rassembler le savoir astronomique au XVIIe siécle', in Isabelle Pantin and Gérard Péoux (eds.), *Magasin de savoirs: Rassembler et distribuer la connaissance par le livre (XVIe–XVIIe siècles)*, Louvain: Press universitaires de Louvain, 2020, pp. 167–8, 166.

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by and embedded in the new selenography. Every name on the map can be cross-referenced with the *Almagestum Novum*'s two prefatory indexes, one chronological and the other alphabetical, which collected dates and biographies of astrologers and astronomers, scholars ranging from Zoroaster to Riccioli. In this sense, the selenographic nomenclature was not just a celestial observation instrument but also a reading tool for internal reference within the vast compendium in which it was published.[80] The selenography, as a visual index for Riccioli's history of astronomy, conveyed a storehouse of knowledge. Understood in this way, it was useful as a learning or memory aid for students when they were challenged to discuss and defend their institution's cosmological commitments in different settings, such as the private courses that supplemented the Jesuit syllabus.[81]

Moreover, the nomenclature, which is a highly rhetorical and technical artefact, gives a prominent place to mathematical teaching in Jesuit institutions, as in Van Langren's case. That is, the selenography was a space of recognition for Jesuit mathematicians in Bologna, where Riccioli himself taught. Framed within the sixth and eighth octants of the discseventeen of the forty-nine lunar spots represented members of Jesuit Colleges. Thus in this new lunar observation scheme was inscribed a particular sociability that acknowledged institutions, confessional circuits of knowledge circulation, and master–apprentice relations, as discussed above in the Brussels printed lunar map. As in Van Langren's case, this selenography, within or independent of its book, travelled beyond Bologna and Jesuit European circuits to the New World and provided both a technical and a rhetorical instrument to its readers in missionary colleges and colonial courts.[82]

Universal enough

Selenographies cannot be reduced to visual renderings of verbal statements concerning cosmological beliefs or to disembodied epistemic images that substituted telescopic views of the Moon through credited virtual technologies. These graphics were astronomical paper instruments created to work within a wide scope of knowledge systems and users. Ingeniously made, these tools mobilized knowledge through lunar nomenclatures that were technical, rhetorical and political.

Mathematics, religion and politics were aligned and articulated in the nomenclatures created by Van Langren, Puteanus, Riccioli and Grimaldi, in a reflection of early modern understandings of the uses of astronomy. As discussed in the two case studies, technical and rhetorical aspects of these schemes were mutually embedded and intertwined within the spaces and actors of scientific practice. Lunar nomenclatures were tools for observation and notation that functioned, simultaneously, as spaces of social and institutional recognition, as a didactic tools and as emblems of political and epistemic ideals. Lunar nomenclatures, selenography's key observation notation and communication devices, were designed through their makers' awareness of the interconnectedness between technical research, social order, the politics of publication, competition, and collaboration in knowledge making.

The selenographies by Riccioli and Van Langren studied in this essay were unique graphical artefacts made in the fragile times of war and peace following the Thirty Years War. Religious considerations did not determine the technical function of these

[80] Riccioli, op. cit. (5), pp. i–xlvii.

[81] William A. Wallace, *Galileo and His Sources: Heritage of the Collegio Romano in Galileo's Science*, Princeton, NJ: Princeton University Press: 1984; Gorman, op. cit. (62), pp. 23–7.

[82] Nydia Pineda de Ávila, 'La cultura visual astronómica desde algunos fragmentos de la biblioteca de Carlos de Siguenza y Góngora, in Marina Garone Gravier and Mauricio Sánchez Menchero (eds.), *Todos mis libros: Reflexiones en torno a las bibliotecas personales en México y América Latina*, Mexico: Centro de Investigaciones Interdisciplinarias en Ciencias y Humanidades-Universidad Nacional Autónoma de México, 2020, pp. 53–74.

paper instruments, but they did play a role in the decisions taken to create mnemotechnical devices for lunar observation. Religious audiences, such as the Society of Jesus, provided channels of distribution for selenography and were evoked in the nomenclatures themselves. Selenographers were aware that with their naming schemes, their observation tools could be used in apostolic missions as instruments for imperial mapping. However, their nomenclatures were contrived to work across religious divides.

Through their nomenclatures, selenographers wanted their instruments to be universal enough. They aspired for them to be ecumenically received, yet they also desired that their artefacts speak to particular audiences who would extend their technical, epistemic, and political agendas. Ultimately, selenographers such as Van Langren, Riccioli and Grimaldi were self-conscious instrument makers who endeavoured to make efficient technical aids for an extended and diversified network of users. At the same time, they infused their paper technologies with a level of irony, ambiguity and open-endedness, and even a sense of humour which, like the Moon, resists being fully captured.

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