The lunar face before the telescope

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Introduction

Among the discussions about geographical names, the lack of names of the the lunar spots before the invention of the telescope is notheworty. What is dignus to be named? A visitable place or at least a visible place, indeed. So the question afforded in this paper is wether the lunar spots are visible with the naked eye, and if they can be distinguished and so named.

Why the Moonspots had no names before Galileo? Arte the Lunar Maria visible to the naked eye? Are they distinguishable and recognizable from one day to another and in different phases?

We obtained drawings of experienced and unexperienced observers, all made observing with naked eyes, in order to "know" the Moon of the ancient times.

Lunar paleotoponymy: the strategy for the observations

The experiment on this "lunar paleotoponymy" starts from the visibility of the lunar features during the phases. Several students of secondary schools have participated to realize the drawings of the Moon seen at naked eyes. The starting condition is not knowing the lunar features, and their visibility in the various phases, otherwise their search would have affected the result of the experiment.[1]

In other words the observers have to ignore the selenography, the order of the main features visible at the telescope like the dark Maria and the Ocean, and the white areas, the Terrae.

An amateur astronomer would already know where the lunar spot are, influencing his/her report.

The rotation of the field of view

The Earth's rotation and the angle of the line between the two horns of the Moon[2] with respect to the local meridian, determine the positions of the lunar features with respect to the horizon and to a vertical line. The "lunar face", which is the common observing experience for the Full Moon or the phases nearby, slightly rotates from East to West.

Fig. 1 The full Moon from rise to set; the black dot is Mare Crysium.[3]

In the Moon drawings the vertical orientation is expected, and this concerns either the cups angle either the features' relative position.

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[1] C. S. observed the tiny with dot of the *Nix Olympica* on Mars at the 4.5" telescope in 1997; that feature appeared in a quiet moment of the atmospheric turbulence, just for a second. That vision is an "expected" one, with the map of Mars already available. In our case we want to assess the visibility of some features on the Moon, without priorly knowing their position.

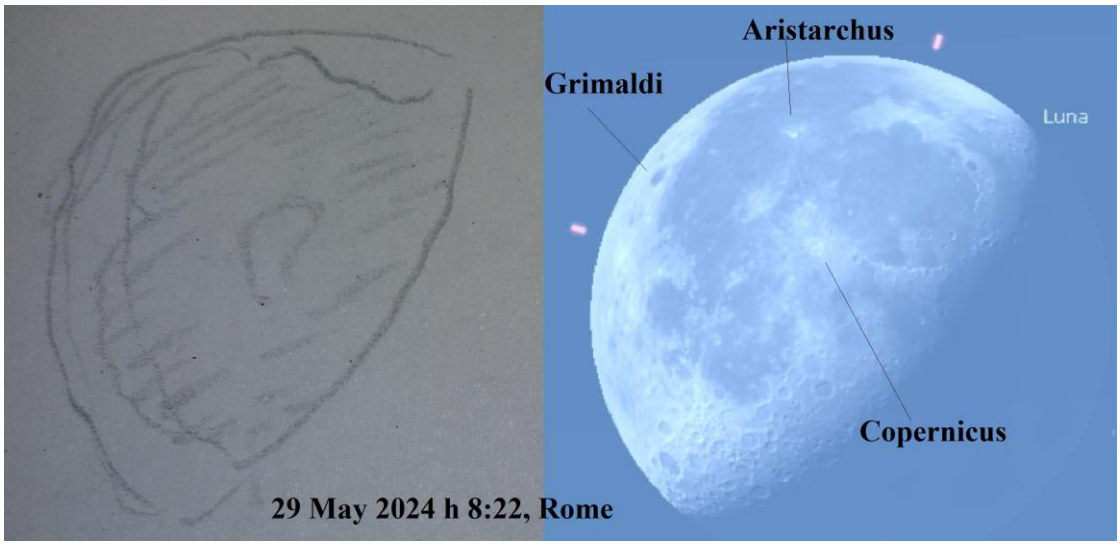
[2] Studied in detail by Ptolemy in the Almagest

[3] Rebecca Porter, Field rotation using the Moon as example, https://www.youtube.com/watch?v=ZfjwLHt-2Jk (2019)

Lunar spots, phases and angles

The professional knowledge of the lunar features has permitted to assess the visibility of some spots during the different phases of the lunar month. Mare Crysium is visible, and the brighter zones in the Oceanus Procellarum (the area of Copernicus crater) are detectable. The basins of Imbrium, Serenitatis, Tranquillitatis and Foecunditatis with the bifurcation at its end are visible, especially in daytime. The luminosity of the sky background helps to see the bifurcation (Mare Nectaris and Mare Foecunditatis), that disappears in night time, because of the high luminosity of the lunar Terrae around them.

Some features like Grimaldi (the darker one) or Aristarchus (the brightest one) are not visible to the naked eye, and also with a 6x18 mm monocular handled they were not visible.

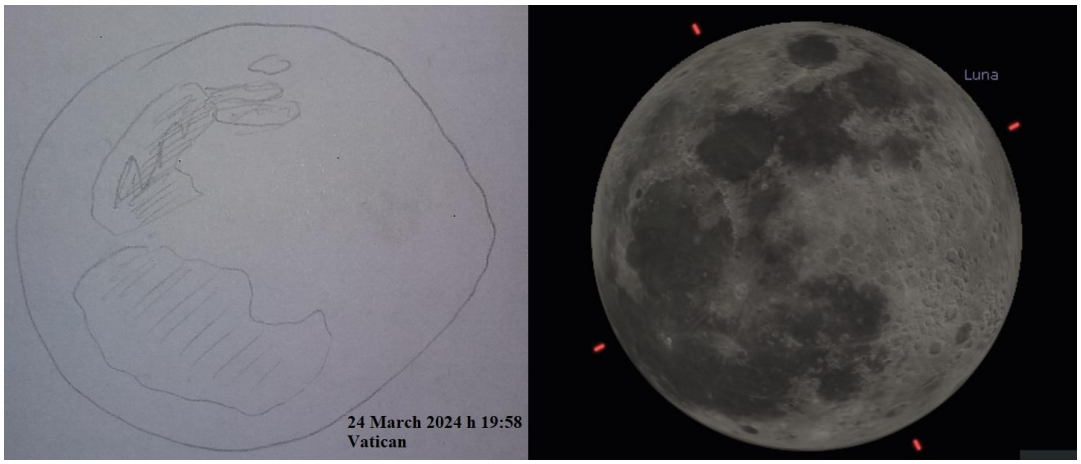


Luna XXI, 20.6 days of age, drawn in Villa Pamphili, Rome, morning time. The brighter Terrae near Copernicus appear near the lunar center. Right: the Moon represented by Stellarium 0.20 at same hour.

Luna XVIII, 18.5 days of age. Drawn in Piazza del Bel Respiro, Rome, morning. The Imbrium basin dominates the top of the image, and right side there is M. Serenitatis, the other Maria are not visible near the terminator.

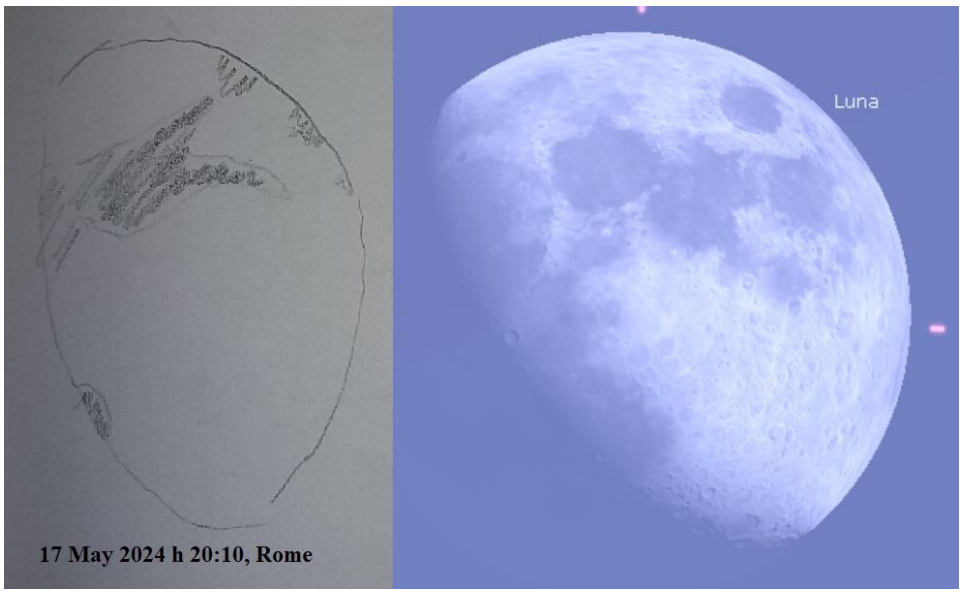
Luna XXIV, 24.1 days of age, from St. Peter's square in Vatican, noon time. The darkness of the Oceanus Procellarum is barely visible.

Luna XXV, 24.5 days of age, from via Fonteiana, Rome. The northern part of the Oceanus Procellarum shows a bifurcation. No other features are discernable.



Luna XIV, 14.3 days of age, drawn near the Vatican Obelisk, night time. The position angle of Mare Crysium at the top is well reported. The difference between Mare Serenitatis and Mare Imbrium is not visible.

Luna XI, 10.6 days of age, from Piazza della Repubblica, Rome, daytime. Mare Nubium in the bottom is drawn with a double structure. Mare Crysium is not well separated from Mare Tranquillitatis and Foecunditatis



Luna IX, 9.4 days of age, from Rome, via della Giuliana, daytime. Mare Nubium is visible in lower left on the terminator.

The Moon of 11.5 days of age, Luna XII on March 21, 2024 at 16:25 at the Michelangelo Cloister in Rome.

The angle of lunar cusps' line with the vertical and the contrast near the terminator

The drawings were made to show the visible features, not aimed to report the angle of cusps' line, nor the accurate phase. Nevertheless the angles are rather accurate ±5°, as well as the orientation of the features in dependance on the field rotation.

The features which are recognizable in different lunar ages are very few, like Mare Crysium or the Oceanus Procellarum. The same features near of far from the terminator are differently recognizable.

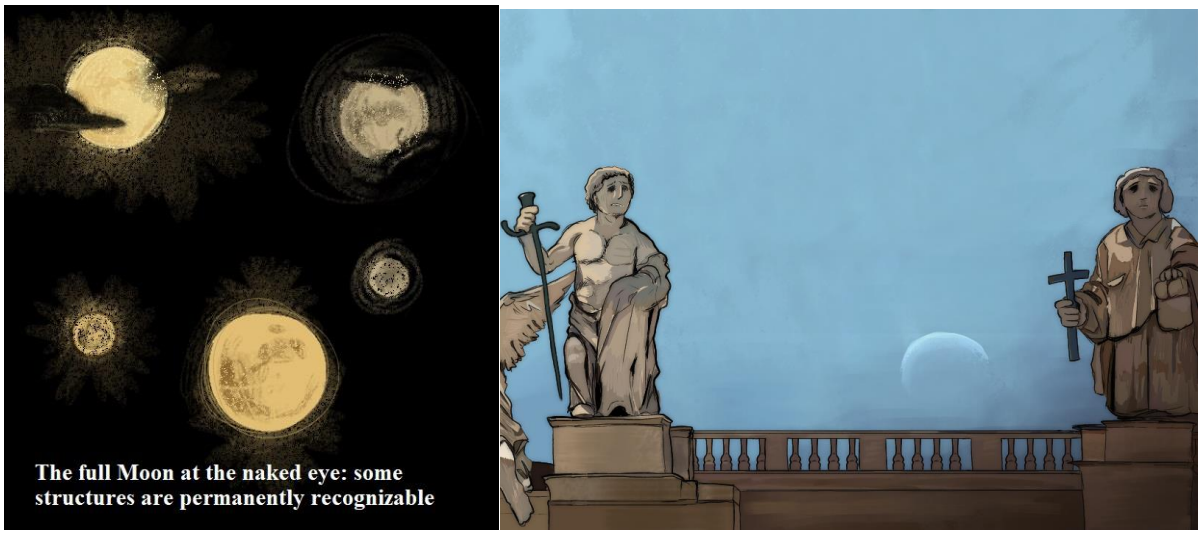
The contrast near the terminator is different with respect to the one of the limb, much brighter than the sky background. The luminosity of the sky in daytime is such that a part of the Moon's visibility is cut when near the terminator. The limb is always bright, when it is illuminated, otherwise it is not visible, excepted the case of ashen light, where it is very difficult to draw some visible features and not on the sunlit part.

Luna III, 2.7 days of age. Photo from Rome, San Paolo. The features of the Eastern side are well visible. To the naked eye these structures are visible only if the illuminated part of the Moon is hidden as already Galileo said in the Letters on the Ashen Lights (Lettere Sul Candore Lunare).

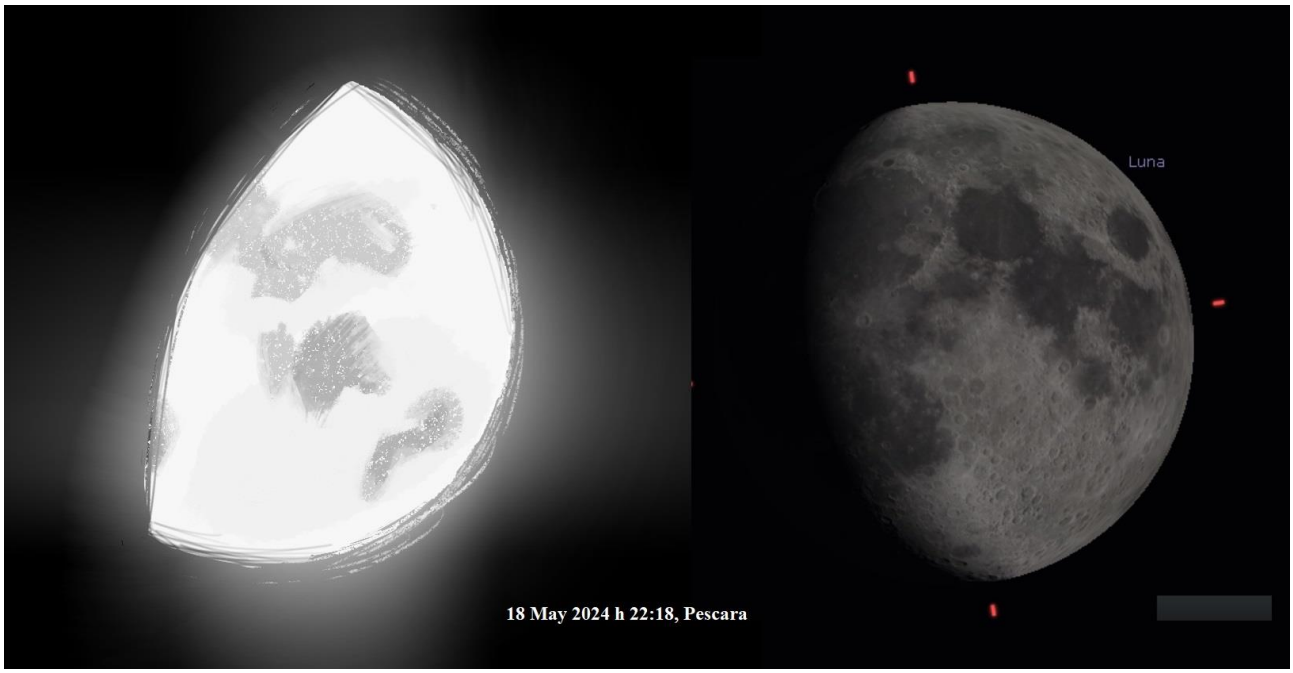
Unexperienced observers

Luna XXV of 24.5 days, from Rome, via Fonteiana. The variability on the cusps' angle is large. The drawing are made on April 4, 2024 h 9:40-10. It is difficult to say if the two albedo maps of the right drawing are real. These drawing put in evidence that the lunar features within 5 days from the new Moon are not visible, for contrast's problem.

Luna XII (21 March 2024 after 16h30); Luna XIV and Luna XV (24 March and 25 March 2024).

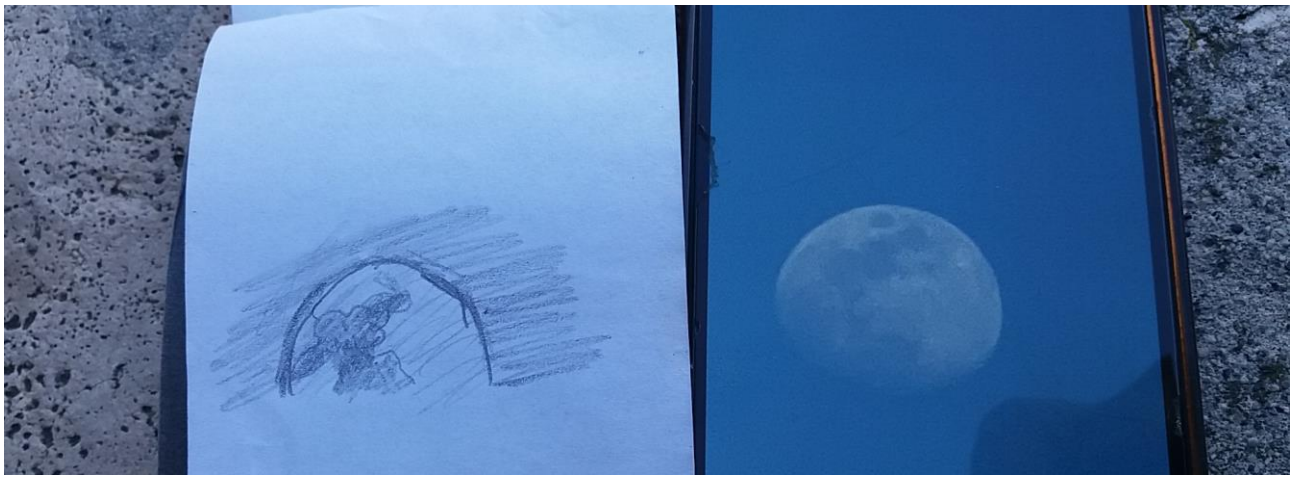


The Moon of 21-26 March 2024, at 21:30 drawn in Pescara: the Mare Crysium on the top of the greatest image is recognizable. Those drawings have been made with the aid of 8x30 binoculars.
The waning Luna XXV of June 1st 2024 h 13:23 at the Vatican has no details, and it is drawn from a video.[4]



This drawing, made with a digital device, shows the Mare Nubium near the terminator, while the structure of the northern Maria is slightly different with respect to the map, but they are three. This drawing has been completed at 22:18, the inclination of the Moon is different (three hours later). The difficulty to see the lunar features in the night is here confirmed.

[4] https://youtu.be/sfm5Rygf47I made with a 6x18 monocular applied to the smartphone J5 Samsung camera at 4x digital zoom. The appearance is like at the eye with the monocular. The drawing made in the previous paragraph, same day and hour is made at naked eye.



The drawing of the Moon on March 21 2024 h 16:20 at the Michelangelo Cloister in Rome, Luna XII 11.5 days.

Plutarch and the Moon

The nickname used by Plutarch for the Moon in *De Facie in Orbe Lunae*[5] (DF) is *blu-eyed.* The Moon shows a face of girl, blue-eyed, using the words of the poet Agesianax (DF 2)

She gleams with fire encircled, but within

Bluer than lapis show a maiden's eye

And dainty brow, a visage manifest.

Empedocles calls the Moon blue or *bright-eyed* (DF 16).

Hence, since each part is separated and has its own boundary, the layers of light upon shadow, assuming the semblance of height and depth, have produced a *very close likeness of eyes and lips*. [DF 2]

The identification of a face, a familiar face, is a psychological issue very common to the human vision.

That identification satisfied, evidently, the ancient peoples. The questions opened in the Plutarch dialogue deal with the possible reflections occurring on the lunar surface: is the Moon reflecting the Oceans of the Earth? Why the Moon does not reflect the stars?

Under the form of a Plato's dialogue, the text of Plutarch touches all the scholarly opinions on the lunar face at his own time, but the Ocean mentioned in the text is only the Earthly one, reflected by the Moon, so not a place on the Moon.

The discussion is on the nature on the Moon, is of Natural Philosophy, instead of Geography or Cosmography.

Conclusions

The aim of this study is not to find historical explanations on the Moon spots, but why they did not have names. The bigger or ancient spots were seen in all times (Galileo Galilei Sidereus Nuncius[6]) the smaller ones have been seen only with the telescope.

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[5] https://penelope.uchicago.edu/Thayer/E/Roman/Texts/Plutarch/Moralia/The_Face_in_the_Moon*/A.html

[6] De facie autem Lunae, quae ad aspectum nostrum vergit, primo loco dicamus. Quam, facilioris intelligentiae gratia, in duas partes distinguo, alteram nempe clariorem, obscuriorem alteram: clarior videtur totum hemisphaerium ambire atque perfundere, obscurior vero, veluti nubes quaedam, faciem ipsam inficit maculosamque reddit. Istae autem maculae, subobscurae et satis amplae, unicuique sunt obviae, illasque aevum omne conspexit; quapropter magnas,

The spots were there in a celestial body encompassing half a degree, used since ever to regulate the month and the human activities. The Moon has been so familiar that it had a face, without other specifications.

The face and the phases showed much more variations with respect to the solar disk, which only occasionally and with special atmospheric conditions showed a dark spot on it.

Before the introduction of the telescope there was no interest in naming the "albedo features" of the Moon.

The experiment conducted with experienced and unexperienced observations has shown that the lunar features are better seen in daylight, without being bleached by the strong luminosity of the Moon on a dark sky. The difficulty to identify such features increases near the New Moon, within approximately ±5 days.

The observations in twilight show some albedo features, and also in the ashen light some features are discernable.

The light terminator is a low contrast region with respect to the sky background, and the Mare Nubium is occasionally visible there, while the lunar sunlit limb is always bright and well defined, but no dark features tend to appear there, excepted Mare Crysium.

The waning Moon is dominated by the large dark area of the Oceanus Procellarum, with a bright spot inside, corresponding to the Copernicus impact crater and its bright ejecta.

The bifurcation of Mare Foecunditatis and Mare Nectaris is also visible during the waxing Moon, were the dominating feature is Mare Crysium, separated near the limb and above the dark complex of Mare Tranquillitatis, Mare Serenitatis and Foecunditatis/Nectaris.

The identification of other albedo features is possible, but it is difficult to consider it a potential discovery process with respect to a comparison with a map. The maximum albedo difference on the Moon is 0.14 units, with the maximum brightness in Aristarchus 0.22, and the minimum in Grimaldi 0.08 (the 8% of the light is reflected). If the Moon would have had more contrasted albedo features, probably it would have received names, for example if would have been like a Secchi disk used in oceanography, each sector would have had his name. The rotation of the field from Moon rise to set contributes to make more complicate the identification of the parts, during the Full Moon. But the main reason is that over the "face of the Moon" nothing new happened from time to time: no brightening nor changes in the forms. The face was always the same, without need of addressing one part instead another.

References

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https://it.wikisource.org/wiki/Lettere_(Galileo)/XXV Secchi Disk: https://en.wikipedia.org/wiki/Secchi_disk

Plutarch, De Facie in Orbe Lunae, in 4 parts, University of Chicago */A */B */C */D https://penelope.uchicago.edu/Thayer/E/Roman/Texts/Plutarch/Moralia/The_Face_in_the_Moon*/A.html

Lunar albedo map (USRA) ARC-1_1Ed_0367_150.jpg (5232×5085) (usra.edu)

seu antiquas, eas appellabimus, ad differentiam aliarum macularum amplitudine minorum, at frequentia ita consitarum, ut totam Lunarem superficiem, praesertim vero lucidiorem partem, conspergant; hae vero a nemine ante nos observatae fuerunt: ex ipsarum autem saepius iteratis inspectionibus in eam deducti sumus sententiam, ut certo intelligamus, Lunae superficiem, non perpolitam, aequabilem, exactissimaeque sphaericitatis existere, ut magna philosophorum cohors de ipsa deque reliquis corporibus caelestibus opinata est, sed, contra, inaequalem, asperam, cavitatibus tumoribusque confertam, non secus ac ipsiusmet Telluris facies, quae montium iugis valliumque profunditatibus hinc inde distinguitur.