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Plutarch and the Law of Reflection: Critical and Literary Commentary to *De facie* 930A-C

[Plutarco y la ley de reflexión: Comentario crítico y literario a *De facie* 930A-C]

by

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Abstract

In 930A-C, Plutarch introduces and immediately rejects the law of reflection because, in his view, the theory is not self-evident nor unanimously accepted. To reinforce this rejection, he provides two examples taken from the field of catoptrics: 1) the images resulting from convex mirrors and 2) those resulting from folding mirrors. Up until now, the slightly corrupted state of the transmitted text and the technical language of the theory and the examples discussed in the passage have prevented scholars from reaching a sound interpretation of the passage. In this paper, I will first address the issues concerning the state of the text, in order to later discuss its problematic content, to wit, whether Plutarch's rejection of the theory that all reflections occur in equal angles was meant to be taken seriously, as resulting from a confrontation between this theory's assumptions and reality, or was due to his interest in conveying an ideal image of the moon, a specific interest that could not fit with this theory's statements.

Key-Words: *De facie*, Textual criticism, Catoptrics, Optics, Rhetoric.

Resumen

En 930A-C, Plutarco introduce y desecha inmediatamente la ley de reflexión porque, en su opinión, la teoría no es evidente por sí misma ni hay unanimidad en su aceptación. Para reforzar su abandono, proporciona dos ejemplos del campo de la catóptrica: 1) las imágenes que resultan en los espejos convexos y 2) las que resultan de los espejos dobles. Hasta ahora, el corrupto estado del texto transmitido y el lenguaje técnico de la teoría y los ejemplos discutidos en el pasaje han impedido a los estudiosos ofrecer una interpretación sólida. En este artículo me centraré primero en las cuestiones relativas al estado del texto para discutir luego su contenido problemático, a saber, si el abandono por Plutarco de la teoría de que todas las reflexiones suceden en ángulos iguales ha de ser tomado en serio, como resultado de una inadecuación entre la formulación de la teoría y la realidad, o se debe a su interés en transmitir una imagen concreta de la luna que entraría en conflicto con los principios de esta teoría..

Key-Words: *De facie*, Textual criticism, Catoptrics, Optics, Rhetoric.

Introduction

The field of catoptrics is a branch of optics concerned with reflection, especially the formation of images by mirrors. One of the principles of the field is the law of reflection, which states that all reflections occur in equal angles, namely that the angle of incidence is equal to the angle of reflection. This law is discussed and rejected in *De facie* 929E-930D[1]. First (929E-930A), Sulla raises the problem of the half-moon as the result of the application of the law. According to him, the shape of a half-moon should never be seen from earth, on the grounds that the rays coming from the sun and reflected on the moon would glance off in the opposite direction and never reach the earth[2]. If, because of the angle in which it is reflected, the ray of light cannot meet our sight, the only natural consequence is that we should not be able to see the half of the moon that is illuminated[3].

To this, Lucius replies that such a law is not self-evident nor accepted by all, and proceeds to reject it on the grounds of the images reflected in two specific types of mirrors (930A-C). The first example involves the images reflected in convex mirrors (τῶν κυρτῶν κατόπτρων) and the second one those reflected in folding mirrors (τοῖς διπτύχοις κατόπτροις). According to him, given that neither of these result from reflection in equal angles, the law is proved to be incorrect.

Unfortunately, the manuscripts have preserved this part of the conversation with quite some textual difficulties, which have hindered the proper understanding of the passage's content. Furthermore, its highly technical language has also hindered a sound interpretation of Plutarch's true intentions when including the law of reflection, convex mirrors and folding mirrors in his text.

1. *Text and Critical Commentary*

According to the manuscripts, the text runs as follows (930A-C):

1 I would like to thank Dr. R. Tobey for reading the passage and providing some notes on it, and Dr. J. A. Koster, whose clarification on the actual functioning of reflecting surfaces, both curved and plane, contributed in great measure to offer new insights on Plutarch's intentions.

2 929E-930A, "Πάνυ μὲν οὖν" ὁ Σύλλας εἶπεν "ἔχει γάρ τινα λόγον τὸ πάσης ἐν ἴσαις γωνίαις γινομένης ἀνακλάσεως ὅταν ἡ σελήνη διχοτομοῦσα μεσουρανῇ, μὴ φέρεσθαι τὸ φῶς ἐπὶ γῆς ἀπ' αὐτῆς, ἀλλὰ ὀλισθαίνειν ἐπέκεινα τῆς γῆς·" The Greek text corresponds to that in preparation for my PhD project: *Critical Edition of Plutarch's treatise* De facie quae in orbe lunae apparet *with critical, literary and philosophical commentaries*.

3 See Image n. 1 in section "4. Images."

ἀνάγκη δὲ εἶπεν ὅτι τὸ πρὸς ἴσας τείνεσθαι γωνίας ἀνάκλασιν πᾶσαν, οὔτε φαινόμενον αὐτόθεν οὔτε ὁμολογούμενόν ἐστιν, ἀλλὰ διαβάλλεται μὲν ἐπὶ τῶν κυρτῶν κατόπτρων ὅταν ἐμφάσεις ποιῇ μείζονας ἑαυτῶν πρὸς ἓν τὸ τῆς ὄψεως σημεῖον, διαβάλλεται δὲ τοῖς διπτύχοις κατόπτροις ὡς ἐπικριθέντων πρὸς ἄλληλα καὶ γωνίας ἐντὸς γενομένης ἑκάτερον τῶν ἐπιπέδων διττῆς ἔμφασιν ἀποδίδωσι καὶ ποιεῖ τέτταρας εἰκόνας ἀφ' ἑνὸς προσώπου, δύο μὲν ἀντιστρόφους τοῖς ἔξωθεν ἀριστεροῖς μέρεσι, δύο δὲ δεξιοφανεῖς ἀμαυρὰς ἐν βάθει τῶν κατόπτρων, ὧν τῆς γενέσεως τὴν αἰτίαν Πλάτων ἀποδίδωσιν·

1 εἶπεν] εἰπεῖν Wyt. *in app*. | ἴσας] τὰς *add. ante* Steph. *et alii*[4] | τείνεσθαι] γίνεσθαι RJ94 *et alii* | **3-4** *iteratio sententiae* ὅταν ἐμφάσεις ... διαβάλλεται δὲ *et lac*. 14 *lit*. E, 11 *lit*. B | **4** ὡς] ὧν RJ94 *et alii* | ἐπικριθέντων] ἐπικλιθέντων RJ94 *et alii* | **5** διττῆς] διττὴν I.22 *et alii* | **7** τοῖς] ἐν *add. ante* τοῖς Emp. *et alii* | ἀριστεροῖς] ἀριστεροῖς *del*. Emp. *et alii*: σαφεστέρας Schmidt: ἐναργεστέρας Raing. | ἀλλ' *add. post* δεξιοφανεῖς Poh. | **7-8** ἐν βάθει] τῷ βάθει Emp. | **6-8** δύο μὲν ἀριστεράς, δύο δὲ δεξιοφανεῖς, τὰς μὲν ἀντιστόφους τοῖς ἔξωθεν μέρεσι, τὰς δὲ ἀμαυρὰς ἐν βάθει τῶν κατόπτρον Wyt. *in app*.

The passage can be roughly split into three sections, each of them dealing with specific issues: 1) textual problems included in the sentence that states the law of reflection; 2) issues included in the sentence that proposes the first example to discredit the theory, beginning with ἀλλὰ διαβάλλεται μέν; and 3) issues in the sentence that proposes the second example, starting with διαβάλλεται δέ.

Section 1) The first correction of the text concerns the verb εἶπεν transmitted by both manuscripts. In this case the correction into εἰπεῖν proposed by Wyttenbach is necessary[5]. The personal form transmitted by the manuscripts plays no syntactic role in the sentence, being just an aside to remind the speaker. However, the following substantive clause ὅτι τὸ πρὸς ἴσας τείνεσθαι γωνίας ἀνάκλασιν πᾶσαν, οὔτε φαινόμενον αὐ-

[4] *Et alii* is used to indicate that an intervention in the text has generally been accepted by scholarship. The designations I.22 and RJ94 refer to the handwritten annotations included in the copies of the Aldine edition belonging to Forteguerri and Turnebus respectively. For the remaining scholars listed above, see the Bibliography.

[5] The confusion between personal forms/participles and infinitives is frequent along the treatise. See, for instance, 931F, with πέφυκε corrected into πεφυκέναι by RJ94; 932C, ἀντιφράξαι into ἀντιφράξῃ by RJ94; 934A, ποιεῖν into ποιεῖ also by RJ94; 934C, ἀμείβειν into ἀμείβει by RJ94 and others; 936E, ἀνακλασθέν into ἀνακλᾶσθαι by Kepler, into ἀνακλασθεῖσα by Amyot, and into ἀνακλασθῆναι by Emperius; 937B, ὁρᾶται into ὁρᾶτε by RJ94 and others; and 943D, ἐοικέναι into ἐοικυῖαι by Wyttenbach.

τόθεν οὔτε ὁμολογούμενόν ἐστιν lacks a verb on which to depend. With the substitution of εἶπεν with εἰπεῖν, the infinitive functions both as subject of the sentence and as verb of the substantive clause, ἀνάγκη functions as attribute, and the clause as object. Then comes the addition of an article to modify ἴσας, by Stephanus, who was followed by scholars of the 16th, 18th and 19th centuries. While it improves the syntax, it is not required by the text. Finally, the verb τείνεσθαι is substituted by an annotation in the Aldine that belonged to Turnebus for γίνεσθαι – an intervention also accepted by several editors. With this modification, the text parallels the formulation of the law of reflection as it appears a few lines above and below: 929F, πάσης ἐν ἴσαις γωνίαις γινομένης ἀνακλάσεως; 930C, οὐ δυνατόν ἐστιν ἐν ἴσαις γωνίαις γίνεσθαι πάσας ἀνακλάσεις. As pertinent as the intervention may be, the verb τείνω ("to stretch," "to spread"), which according to *LSJ* can be applied to light and sound, fits the context.

Section 2) The first issue at stake is that both manuscripts repeat a sentence, from ὅταν ἐμφάσεις to διαβάλλεται δέ, after which they add a blank that occupies approximately 10 to 15 letters depending on each manuscript. The repetition of a sentence in both manuscripts clearly shows the difficulty of the passage. In this sense, the lacuna should be interpreted as the realization on behalf of the copyist that something was off, not as reflecting the loss of part of the text.

Beside the iteration, the main difficulty concerns the type of mirrors being described. The term κυρτῶν has traditionally been interpreted to mean "convex spherical." This is problematic because such mirrors reflect an image smaller than the original, not bigger as the text states (ἐμφάσεις ποιῇ μείζονας)[6]. As Cherniss pointed out, what the text really means is "convex cylindrical" mirrors[7]. This type of mirrors offer a reflection that is shrunk in one sense and regular in the other, so the image appears as long and narrow. This is what ἐμφάσεις ποιῇ μείζονας ἑαυτῶν πρὸς ἓν is meant to express: images that are bigger just in one respect, namely not proportionally magnified in general. The adjective μείζονας, then, no longer poses a problem.

Section 3) This represents the most problematic part of the passage. The first issue concerns the manuscripts' reading ὡς ἐπικριθέντων: the meaning of the verb, "to decide about or against," "to choose," does not seem to fit the context, and the adverb seems somehow out of place, reason why both were modified by an annotation in Turnebus'

6 See H. CHERNISS, 1951, p. 142 and notes 26-28, for some interventions in the text derived from this misunderstanding.

7 H. CHERNISS, 1951, pp. 142-143. Plutarch does refer to convex spherical mirrors elsewhere in *De facie* (937A), but in such case he describes them as τὰ δὲ κυρτὰ καὶ τὰ σφαιροειδῆ.

Aldine into ὧν ἐπικλιθέντων. The relative pronoun refers to the antecedent τοῖς διπτύχοις κατόπτροις and the verb's meaning, "to lean on," "to bend toward," is a simple but effective emendation. While I agree with the replacement of a verb that made no sense in the present passage, I have reservations about the modification of the adverb. It is true that ὧν improves the syntax of the sentence, but ὡς is not *per se* a bad reading, reason why I maintain the manuscripts' text in this case.

A second issue concerns the form διττῆς: given that it modifies the noun ἔμφασιν, it must be corrected into an accusative, as Forteguerri first suggested[8]. Raingeard, however, maintains the manuscripts' reading and points (in his commentary) that it modifies γωνίας ἐντὸς γενομένης[9]. In that case the subject of the main clause (ἑκάτερον τῶν ἐπιπέδων) breaks the genitive absolute in two pieces, which is highly doubtful. Furthermore, it is more plausible that the numeral modifies the noun that immediately follows it rather than a noun mentioned a while earlier.

Then comes the problematic nature of the images created by the folding mirrors. These, being inclined to each other and having formed an inner angle, are said to give a double image of a single object and to create four likenesses, two of a kind, and the other two of another[10]. The first two images are ἀντιστρόφους, "reversed," and are located τοῖς ἔξωθεν ἀριστεροῖς μέρεσι, in "the parts that are outer left." The first issue at stake is that the two left parts of two folding mirrors cannot both be at the same time "outer"[11]. The other two images are ἀμαυράς, "dim," "faint," located ἐν βάθει τῶν

8 While the correction is accepted by most modern scholars, they all attribute it to Turnebus. As I have argued elsewhere (L. Lesage Gárriga, 2018, 250-251), this is not an uncommon mistake. Many editors include Forteguerri's corrections in their text, but no single one ever attributed such corrections correctly. Consequently, Forteguerri's contribution to *De facie* has not yet been acknowledged in modern apparatuses.

9 P. Raingeard, 1934, p. 101. The Aldine edition (1509) reads γενομένοις instead of γενομένης, a mistake probably due to iotacism and soon corrected by Forteguerri, Leonicus and Turnebus in their personal copies.

10 As Dr. Tobey pointed out to me, it should be noted that only curved optics, namely concave or convex mirrors or lenses, can make images; plane surfaces, such as the mirrors described in this part of the passage cannot. The reason why human beings can see an image in the (flat) mirror is that we have a lens in the eye. Also, it should be taken into account that there will be four images only if two conditions are met: 1) the angle formed by the two mirrors must be of a certain degree, and 2) the object must be close enough so that it appears reflected both in the inner and outer parts of each mirror. See Image n. 2, at the end of the paper, and also the drawing in L. Lehnus, 1991, p. 143 n. 136.

11 See Image n. 2.

κατόπτρων, "in the depth of the mirrors." But they are also said to be δεξιοφανεῖς, an adjective that has two different meanings: "shown straight," namely not reversed (thus opposed to ἀντιστρόφους above), and "shown on the right side" (thus opposed to ἀριστεροῖς, above)[12]. Some scholars have interpreted in its second meaning[13], which in turn poses the same problem as ἀριστεροῖς: the two right parts of two folding mirrors cannot both be in depth, in the inner angle. This allows for the exclusion of δεξιοφανεῖς' second meaning, but the problem with ἀριστεροῖς still remains.

Scholars have tried to solve it differently. First, Wyttenbach reorganized most of the sentence into δύο μὲν ἀριστεράς, δύο δὲ δεξιοφανεῖς, τὰς μὲν ἀντιστρόφους τοῖς ἔξωθεν μέρεσι, τὰς δὲ ἀμαυρὰς ἐν βάθει τῶν κατόπτρων. While his conjecture provides the passage with sense, it is difficult to explain how the text could corrupt from this to the reading transmitted by the manuscripts. Emperius corrected several parts: he added the preposition ἐν before the syntagma τοῖς […] μέρεσι, secluded the problematic ἀριστεροῖς – which should be seen as a gloss integrated in the text following a misinterpretation of the meaning of δεξιοφανεῖς −, and turned the preposition ἐν before βάθει into the article τῷ. The text then reads:

> δύο μὲν ἀντιστρόφους <ἐν> τοῖς ἔξωθεν [ἀριστεροῖς] μέρεσι, δύο δὲ δεξιοφανεῖς ἀμαυρὰς τῷ βάθει τῶν κατόπτρων.

Most scholars accept his reconstruction of the text, but in my view it includes too many interventions. The first intervention improves the syntax but is unwarranted, and the third is simply needless. In what regards the main one, the seclusion of the problematic term, while appearing as the easiest solution, it actually presumes two different mistakes: 1) the misinterpretation of the following term δεξιοφανεῖς, and 2) the wrong inclusion of a gloss meant to parallel that term. A few scholars solved the problem differently. Schmidt suggested to modify ἀριστεροῖς into σαφεστέρας, meaning "clearer," "more distinctive;" and Raingeard, in the same line, into ἐναργεστέρας, meaning "clearer," "more visible." And Pohlenz, while accepting only the seclusion by Emperius, added ἀλλ' after δεξιοφανεῖς, which is superfluous.

[12] Plutarch's description agrees with reality: the reversed image is in the outer part of the mirror and the straight one in the inner part [see Image n. 3]. This is due to the fact that the inner image is the result of a reflection from a reflection. It should be noted, however, that modern mirrors create four images of the same quality. The techniques with which ancient cultures elaborated their mirrors, differently, implied a great loss of quality. This would entail a great distortion and dimness particularly in the two images placed in the inner part, because they are a reflection from a reflection.

[13] J. AMYOT, 1572, p. 619; A. O. PRICKARD, 1911, p. 29; and D. WYTTENBACH, 1797, p. 764.

In my view, the meaning of Schmidt's and Raingeard's corrections fits the context, but the solution of the latter is the most suitable from a palaeographic perspective: ἐναργεστέρας would have been corrupted into ἀριστεροῖς by the loss of the first syllable (ἐν) due to haplography with the ending of the previous word (ἔξωθεν), and by the attraction to the case of the surrounding words, all in dative (τοῖς […] μέρεσι). I thus accept Raingeard's ἐναργεστέρας.

With these few interventions, the text acquires meaning. The Greek text reads:

> ἀνάγκη δὲ εἰπεῖν ὅτι τὸ πρὸς ἴσας τείνεσθαι γωνίας ἀνάκλασιν πᾶσαν, οὔτε φαινόμενον αὐτόθεν οὔτε ὁμολογούμενόν ἐστιν, ἀλλὰ διαβάλλεται μὲν ἐπὶ τῶν κυρτῶν κατόπτρων ὅταν ἐμφάσεις ποιῇ μείζονας ἑαυτῶν πρὸς ἓν τὸ τῆς ὄψεως σημεῖον, διαβάλλεται δὲ τοῖς διπτύχοις κατόπτροις ὡς ἐπικλιθέντων πρὸς ἄλληλα καὶ γωνίας ἐντὸς γενομένης ἑκάτερον τῶν ἐπιπέδων διττὴν ἔμφασιν ἀποδίδωσι καὶ ποιεῖ τέτταρας εἰκόνας ἀφ᾽ ἑνὸς προσώπου, δύο μὲν ἀντιστρόφους τοῖς ἔξωθεν ἐναργεστέρας μέρεσι, δύο δὲ δεξιοφανεῖς ἀμαυρὰς ἐν βάθει τῶν κατόπτρων, ὧν τῆς γενέσεως τὴν αἰτίαν Πλάτων ἀποδίδωσιν·
>
> Translation: "Yet it must be said that the proposition 'all reflection occurs at equal angles' is neither self-evident nor an admitted fact, but it is refuted in the case of convex mirrors, when the point of incidence of the visual ray produces images that are bigger in one respect; and it is refuted by folding mirrors, as each of the planes inclined to each other and having formed an inner angle exhibits a double image and creates four likenesses of a single object: two reversed, clearer in the outer parts, and two straight, dim in the depth of the mirrors; the cause of the production of these Plato explains."

2. *Literary Commentary: then, what is the problem with catoptrics?*

Once the textual issues have been resolved, one might think that the passage has been sufficiently elucidated. Lucius replies to Sulla's concerns about the half-moon, which rely primarily upon the law of reflection[14]. To do so, he discredits the law on the grounds of the type of images created by convex mirrors and by folding mirrors. The issue is that the images described in both examples are in fact the result of the application of the law of reflection. In other words, the two examples used by Lucius do not disprove the law at all!

While most scholars commenting on the passage neglect to mention this unexpected fact, some simply note the

[14] For a general approach to the law of reflection and to the field of catoptrics, see the diachronic study of A.M. Smith, 2014.

incongruence without looking for a cause[15]. The easiest interpretation would be that there is no cause for this mistake, that Plutarch thought the examples he was using were proof of the law's inadequacy. It is true that the images created both by convex and folding mirrors could be taken as the result of angles of reflection that are not equal to those of incidence. The long, narrow figure resulting in the first case, and the four likenesses of a single object projected by two mirrors in the second can indeed be confusing in this sense. This interpretation, however, is problematic. On the one hand, to assume the author's ignorance as the explanation for a difficult text is in my view too simplistic.

On the other, Plutarch's sloppiness in this passage clashes with the overall elevated tone of the treatise. Throughout *De facie*, the discussion of theories belonging to the theoretical sciences –arithmetic, geometry, astronomy, philosophy– proves an accurate understanding and a high level of precision regarding these sciences. The use of two inadequate examples when disproving a theory is doubtful. Furthermore, despite the inadequacy of the examples for the specific purpose they were being used, the accurateness of the description as to how the two types of mirrors work implies solid knowledge of the phaenomenon of reflection. This, in turn, would contradict the assumption that Plutarch was unfamiliar with catoptrics.

For these reasons, I am inclined to think that Plutarch was in fact aware that these examples were not adequate to reject the law of reflection. This, however, does not solve the difficulties involved in the passage, given that it raises the question as to why he would try to disprove a theory on grounds that he knew were wrong. My suggestion is that he was not trying to disprove the law of reflection altogether, hence the useless examples. A first argument in favor of this hypothesis is that Plutarch's main objective for most of the treatise consists in the defense of the moon's earthiness. Given that the law of reflection accounts for the lunar phaenomena if the moon's surface is presumed to be rugged and uneven, as that of the earth, I highly doubt that he would have truly meant to discredit this valuable law[16].

A second argument in favor of the hypothesis is that there is evidence suggesting his familiarity with the work of thinkers that determined the universality of the law of reflection. Among these thinkers were Euclid (3rd c. BCE), and Hero of Alexandria (1st half of the 1st c. CE)[17].

15 V. RAMÓN PALERM, 2001, p. 159; B. MOTA, 2010, p. 59; and A. LERNOULD, 2013, p. 41 do not signal Plutarch's mistake. A. O. PRICKARD, 1911, p. 56; and H. CHERNISS. 1951, p. 143 simply mention that the law does apply in these cases too.

16 I owe this clarification to Dr. J. A. Koster.

17 See O. NEUGEBAUER, 1938, pp. 21–24 and T. HEATH, 2013, pp. 353-354.

It has been suggested that Plutarch's wording when stating the law in *De facie* parallels the words of Hero's extant fragments of the *Catoptrica*, which points to the fact that Plutarch might have read Hero and knew about the legitimacy of the law of reflection[18]. Furthermore, the proposition 19 of Euclid's *Optics* assumes this law and states that it had been explained in his *Catoptrica*[19]. As Cherniss noted, this proposition is supposed to have been part also of Euclid's *Dioptrica*, which Plutarch explicitly quotes in *Non posse suaviter vivi* 1093E[20].

At this point, one question remains: if Plutarch was aware of the uselessness of the examples that he was providing, and was in fact not even trying to discredit the law of reflection, what is the purpose of the passage? The point of attention is not focused on "real," physical, problems within the field of catoptrics; Plutarch's concerns, I argue, are rhetorical. The context supports the argument that Plutarch's rejection of the law is in fact a rhetorical device. As stated above, the law of reflection is presented by Sulla as the foundation for the problem of the half-moon. Lucius' primary goal in this passage is to convincingly refuse the problem of the half-moon and his best argument is to reject the very law that according to Sulla lies as its base. Thus, his rejection is not an end in itself but simply serves as a means. It is reasonable to think that Plutarch should be concerned by the problem of the half-moon rather than by the law of reflection. The latter, as stated above, advocates for the moon's earthy nature. The former, however, is a strong argument against the defenders of an earthy moon, because if a moon that is earthy cannot show only one half illuminated and yet we do see this happening twice every month, the logical consequence is that the moon cannot be earthy. This consequence Plutarch cannot allow, given that he seeks to prove the earthiness of the moon for most of the treatise.

The argument that the rejection of the law is a rhetorical device seems to be further supported by the following lines of the text (930CD). Lucius proceeds to turn around his line of argument and decides to accept the law of reflection, only to later restrict its use to some specific cases[21]. To corroborate this view, he includes a case in which the law cannot be applied: the uneven and rugged surfaces, such as that of the moon, because, according to him, "in

18 See L. Nix & W. Schmidt (eds.), 2010, pp. 313-314.

19 T. Heath, 1963, p. 267. B. Mota, 2012, pp. 469-502, highlighted the connections between astronomy and the *Catoptrica* in light of sources such as Plutarch.

20 H. Cherniss, 1957, pp. 106-107 n. d. *Non posse* 1093E: τίνας οἰόμεθα καὶ πηλίκας ἡδονὰς ἀπὸ γεωμετρίας δρέπεσθαι καὶ ἀστρολογίας Εὐκλείδην γράφοντα τὰ διοπτικά.

21 930C, Οὐ μὴν ἀλλὰ εἰ δεῖ τοῦτο χαρίζεσθαι τῇ πολλὰ δὴ φίλῃ γεωμετρίᾳ καὶ δοῦναι.

this type of surfaces the rays would be multifariously reflected and intertwined, coming to us as if proceeding from many mirrors."[22] It should be noted that, again, just as with the examples of two types of mirrors in the first part of the passage, the example chosen by Plutarch to embody the law's exception is incorrect: the rugged surface of the moon does not advocate for the inadequacy of the law, on the contrary, it shows its accuracy.

This overturning of position shows that the rhetorical strategy consists in a bipartite attack: 1) plain rejection of a theory, and 2) acceptance with objections that apply in particular cases and that still discredit the theory. The parallel structures, with the inclusion of examples to corroborate each part of the bipartite attack, strengthen the effect. Plutarch seems to be fond of this rhetorical strategy, given that it appears elsewhere in *De facie*[23]. It serves as a powerful tool against any theory. In this case, if the law of reflection is false, there is no issue concerning the half-moon; if the law is reasonable but does not always apply, there still is no issue concerning the half-moon. The particularity of this case is that, for his argument against the problem of the half-moon, Plutarch chooses to disprove a theory that he is not against. This explains why he includes examples that do not invalidate the law of reflection. The two types of mirrors in the first case and the rugged and uneven surface of the moon in the second not only are completely useless for the chosen purpose, but even corroborate the opposite arguments: 1) that the law is correct and 2) that it applies in all cases. Of course, only a readership fully versed in catoptrics could have noticed the fine rhetorical strategy at play.

3. *Conclusions*

After disentangling the highly technical tone of the passage and solving the textual difficulties, a better understanding of the text can be reached.

The first conclusions concern the textual corruptions and their plausible emendations. It has become clear that, despite the elevated number of interventions by previous scholarship, not many were actually indispensable. Given that the manuscripts provide a

[22] 930CD, πρῶτον μὲν ἀπὸ τῶν ἠκριβωμένων ταῖς λειότησι συμπίπτειν ἐσόπτρων, εἰκός ἐστιν· ἡ δὲ σελήνη πολλὰς ἀνωμαλίας ἔχει καὶ τραχύτητας ὥστε τὰς αὐγὰς ἀπὸ σώματος μεγάλου προσφερομένας ὕψεσιν ἀξιολόγοις ἀντιλάμψεις καὶ διαδόσεις ἀπ' ἀλλήλων λαμβάνουσιν, ἀνακλᾶσθαί τε παντοδαπῶς καὶ περιπλέκεσθαι καὶ συνάπτειν αὐτὴν ἑαυτῇ τὴν ἀνταύγειαν οἷον ἀπὸ πολλῶν φερομένην πρὸς ἡμᾶς κατόπτρων.

[23] See, for instance, 934AD, where the issue whether τὸ ἀνθρακῶδες is the moon's particular color or not is discussed. In this occasion the strategy is employed by Lamprias, who can be considered a mentor figure to Lucius in the treatise.

legitimate text, one should avoid unwarranted interventions. With the corrections εἰπεῖν, ἐπικλιθέντων, διττήν and ἐναργεστέρας, the textual problems have duly been assessed and solved in a way that is both effective and respectful to the readings of the manuscripts.

Two further conclusions concern the interpretation of the contents. Firstly, the passage does not result from Plutarch's insufficient knowledge or misunderstanding of catoptrics. In fact he was not rejecting the law of reflection, as it first appears, but was creating a rhetorical strategy. Secondly, this strategy has to be placed within the boundaries set by real and ideal constructions of reality. What is at play in the passage is Plutarch's interest to convey a specific image of the moon, namely a moon of earthy nature. The idealistic image that he tries to promote – regardless whether it corresponds with the moon's true nature or not − enters in conflict with the problem of the half-moon raised by Sulla, reason why Lucius objects to the foundation of this problem, namely the law of reflection. However, given that there is no real attempt to disprove the law, the two examples he uses are unreal, but in order to appear as convincing as possible they are presented in a highly (confusing) technical language. In the dialogue between Lucius and Sulla there is no real trouble with catoptrics, there is a rhetorical use of notions of catoptrics for the sake of the moon's ideal image.

4. *Images*

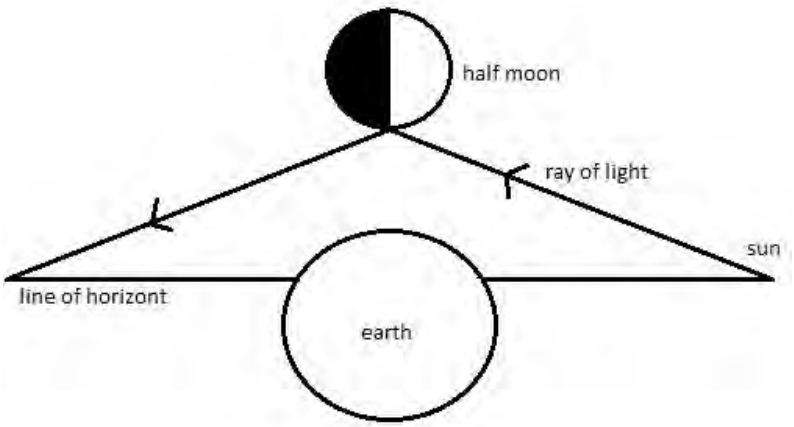

Image 1

Visual example of Sulla's argument based on H. Görgemanns' drawing (1970, p. 72).

Image 2
Reflection of four images in folding mirrors.

Image 3
Reversed and straight reflections in folding mirrors.

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