Cicero on Optics (*Att.* 2.3.2)

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ONLY ONCE IN HIS EXTANT WORKS did Cicero write on optics. While the passage shows no great scientific learning, commentators have generally underestimated the accuracy of his optical insight. In December 60 Cicero writes to Atticus (*Att.* 2.3.2) defending the narrowness of his windows with a Greek tag. The text is that of the OCT:

Cyrus aiebat viridariorum διαφάσεις *latis luminibus non tam esse suavis; etenim* ἔστω ὄψις μὲν ἡ Α, τὸ δὲ ὁρώμενον ΒΓ, ἀκτῖνες δὲ †ΑΙΓΑ† *vides autem cetera; nam si* κατ' εἰδώλων ἐμπτώσεις *videremus, valde laborarent* εἴδωλα *in angustiis; nunc fit lepide illa* ἔκχυσις *radiorum.*

viridiorum NKΦ, *vridiorum* Δ, *viridariorum* Lamb.

There are three difficulties.

The first is that Cicero uses ὄψις for the eye, which has caused unnecessary confusion: it may rather be a key to Cicero's source. Watt remarks that ὄψις is probably a slip since in Euclid *Optica* ὄμμα is eye and ὄψις = ἀκτίς (ray),[1] while Shackleton Bailey cites as a parallel the usage from Olympiodorus (*ad* Arist. *Mete.* 3.2).[2] More apropos is Archimedes, who regularly uses ὄψις for the pupil of the eye (*Aren.* 1.12–16).[3] And there is nothing unlikely in Cicero citing Archimedes—note the encomium at *Tusc.* 5.64–66. The theorem as cited is rather similar to Euclid *Optica* 1, which demonstrates that no object is seen in its entirety at once[4]—perhaps Cicero (or his architect Vettius Cyrus) is citing a lost *Optics* of Archimedes?[5]

[1]W. S. Watt, "Notes on Cicero, *Ad Atticum* 1 and 2," *CQ* NS 12 (1962) 254–255.

[2]D. R. Shackleton Bailey, *Cicero's Letters to Atticus* 1 (Cambridge 1965) *ad loc.* (p. 356).

[3]See A. Lejeune, "La Dioptre d'Archimède," *Société Scientifique de Bruxelles. Annales. Série 1. Sciences mathématiques, astronomiques et physiques* 61 (1947) 27–47. His discussion of ὄψις in Archimedes is on pp. 36–37. See also C. Mugler, *Dictionnaire historique de la terminologie optique des Grecs* (Paris 1964) 292–295 (*s.v.* ὄψις 3, 4).

[4]I may just mention the useful but neglected translation of Euclid's *Optics*: H. E. Burton, "The Optics of Euclid," *Journal of the Optical Society of America* 35 (1945) 357–372.

[5]The lost *Catoptrics* (frr. 17–21 Heiberg) cannot be meant as it concerned mirrors, and is probably a misattribution of the extant pseudo-Euclidean *Catoptrics* of ca 300 B.C.: see Wilbur R. Knorr, "Archimedes and the Pseudo-Euclidean *Catoptrics*: Early Stages in the Ancient Geometrical Theory of Mirrors," *AIHS* 35 (1985) 28–105. The

But the difficulties do not cease with the ὄψις—the ray-labels are corrupt. Constans conjectured "... ἀκτῖνες δὲ δ κ. τ. λ. *vides* ..." for the crux.[6] Watt reads "... ἀκτῖνες δὲ †ΑΙΓΑ† *vides* ...," and conjectures "... ἀκτῖνες δὲ αἱ <ΒΑ>, ΓΑ. *vides* .... "[7] Shackleton Bailey reads "... ἀκτῖνες δὲ †ΑΙΤΑ† *vides* ...," and conjectures "... ἀκτῖνες δὲ κατὰ ταῦτα. *vides* .... "[8] I suggest we restore "... ἀκτῖνες δὲ αἱ <Α>Γ Α<Β>. *vides* .... " The ... ΑΙΑΓΑ ... of the manuscripts might lose the A between the similar vertical lines I and Γ. The ray-labels must be ΑΓ and ΑΒ as the vision-rays emanate *from* the eyes, and the rays were always so drawn (Euclid *Optica* 1, etc.).[9]

Moreover, neither Watt nor Shackleton Bailey understands Cicero's argument.[10] The key to the argument I believe lies in the words *viridariorum* and *suavis lepide*. Ancient optical theory supposed vision rays emanated from the eyes and produced vision, and that these rays could be weakened by passage through certain media.[11] On the other hand, if green objects (as found in *viridaria*) were gazed upon or if the vision rays could be concentrated, the eyes were less fatigued and the seeing was more pleasant (*suavis*, *lepide*).[12]

Lambinus' conjecture is surely correct. Hence, just as Cicero says, greenery (already restful) is more pleasant when viewed through narrow windows,

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author seems to use ὄψις = ἀκτίς: see J. L. Heiberg, *Euclidis Opera omnia* 7 (Leipzig 1895) xlix–l.

[6]L.-A. Constans, *Cicéron. Correspondance*[5] 1 (Paris 1962) 181.

[7]See Watt (above, n. 1), and *id.* (ed.), *M. Tulli Ciceronis Epistulae* 2.1 (Oxford 1965) *ad loc.*

[8]Shackleton Bailey (above, n. 2) and in his Teubner text (1987) *ad loc.*

[9]So also Shackleton Bailey (above, n. 2) and Watt (above, n. 1), though neither actually suggests ΑΒ and ΑΓ for Cicero.

[10]Watt (above, n. 1) dismisses Cicero: "He gets as far as constructing his diagram and then breaks off, having proved precisely nothing. Obviously the 'demonstration' must not be taken seriously; Cicero is probably repeating a sample of the architect's jargon and poking fun at it." Shackleton Bailey (above, n. 2) concludes "just how Cicero's demonstration would have proceeded I am not sure; neither, perhaps, was he."

[11]See for example Plato *Ti.* 45c–d ("fire-stream" of sight, a precursor of vision rays), Aristotle *Mete.* 3.2 (372a29–34), 3.3 (372b15–17), 3.4 (373a32–b10), 3.4 (374b7–18), Heron *Catoptrica* 2, and Galen *De usu partium* 10 (Kühn 2.66–67). Compare A. E. Haas, "Antike Lichttheorien," *Archiv für Geschichte der Philosophie* 20 (1907) 345–386. Even Cicero *Rep.* 6.19 of the sun's light overwhelming our vision.

[12]For the refreshing effect on the vision of green see Pliny 37.62–63, where *smaragdi* are best but green plants are *iucundus visu* also. For the desirability of concentrating the vision, note Plato *Ti.* 45b–c vision occurs because the fire is concentrated in the eyes (τὸ ... πῦρ εἰλικρινὲς ἐποίησαν διὰ τῶν ὀμμάτων ῥεῖν λεῖον καὶ πυκνὸν ὅλον μέν, μάλιστα δὲ τὸ μέσον ξυμπιλήσαντες), Aristotle *Mete.* 3.4 (374b11–12) ἡ ὄψις ἐκτεινομένη ἀσθενεστέρα γίνεται καὶ ἐλάττων (so by inference it is stronger if concentrated), the inference to be drawn from Euclid *Optica* 1—it is harder to look on a larger object as our vision rays must traverse a greater span, and Pliny 37.64 *iidem* [sc. *smaragdi*] *plerumque concavi ut visum conligant* (the final beneficial property).

since (as his diagram is intended to show) the vision rays are concentrated. Atticus saw what Cicero meant. Cicero also refers to the Epicurean εἴδωλα theory of vision, according to which the εἴδωλα would be *constrained* by the narrow spaces (i.e., the narrow windows would have the opposite effect). This he rejects: vision rays were more scientifically respectable in antiquity and are found in all the optics textbooks from Euclid to Damianos.[13]

Thus I would translate as Shackleton Bailey, save for the sentence "*etenim* ἔστω . . . †AITA†," which would be: "For let the eye be A, the object seen BΓ, and the vision-rays AΓ, AB." And, just as Cicero says, to one familiar with the standard theory, "you see the rest": the vision rays are concentrated by the narrow aperture and so the viewing of the already restful greenery is made more pleasant.[14]

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[13]Richard Schöne, *Damianos Schrift über Optik* (Berlin 1897). See Fr. Hultsch, "Damianos (3)," *RE* 4 (1901) 2054–55; Knorr ([above, n. 5] 84–96) dates him to the sixth century A.D.

[14]I am indebted to E. E. Schütrumpf and W. M. Calder III for critical readings.