

Strategies of Argument
*Essays in Ancient Ethics, Epistemology,
and Logic*

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THE EPISTEMOLOGY OF PTOLEMY'S
ON THE CRITERION

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1.

Among the works of the ancient Greek mathematician and astronomer Ptolemy of Alexandria (fl. second century AD) is a short text on philosophical topics entitled *On the criterion and commanding faculty* (περὶ κριτηρίου καὶ ἡγεμονικοῦ).¹ The two-part title reflects a basic division in the text between a longer first section primarily concerned with epistemology (chapters 1–12) and a second, shorter part devoted to psychological issues (chapters 13–16). Ptolemy's main goal in the first section is to set out a detailed account of the κριτήριο—"the mechanics of making a judgment," in the trenchant formulation of John Dillon²—drawing a close analogy with the process of legal judgment as practiced in the lawcourt or δικαστήριο. By means of a detailed elaboration of this analogy he is able to explain how the various faculties and activities of the soul—especially sense perception (αἴσθησις), intellect (νοῦς), and reasoning (λόγος)—work together to produce scientific knowledge. My aim in this paper is to offer an interpretation of the epistemological theory set out in the first part of *On the criterion* and to relate it both to the philosophical tradition and to Ptolemy's investigations in the ancient exact sciences, particularly astronomy, harmonics, and optics.

Ptolemy's decision to address the topic of the κριτήριο should be viewed as a deliberate effort to engage with the philosophical tradition.³ By the second century AD the term had long been a touchstone of epistemological discussion. Works *On the*

¹ I refer to the text as *On the criterion* throughout; references are to the chapter number, page, and line of the standard modern edition (Lammert 1961). Translations are my own and are based on Lammert's text unless otherwise indicated. For an English translation of the entire text see Huby and Neal 1989. The most thorough and incisive commentary (in Latin) is Bullialdus 1663, which also includes a Greek text and Latin translation.

² Dillon 1993: 61.

³ Such a concern fits very well with what we know of Ptolemy's intellectual orientation from his principal scientific works; see for example the opening chapter of the *Almagest* (I.4–7 Heiberg),

criterion (περί κριτηρίου) are attributed to both Epicurus and Posidonius, and Alcinous begins his exposition of Platonic epistemology in the *Didaskalikos* with an account of the κριτήριο.⁴ A brief rundown of the various uses of the term will help to situate Ptolemy's account against the philosophical background.⁵ In its most general sense the term κριτήριο refers to an instrument or means of judgment, with no implications about what kind of instrument or how it is to be used. In Plato and Aristotle the term is used of an ability or capacity to judge.⁶ By a natural extension of this sense, κριτήριο came to be used of specific faculties of the soul such as sense perception or reason, conceived of as instruments of judgment. This usage is not associated with any particular epistemological theory insofar as it implies nothing about the reliability of the faculties in question or how they should be employed. More specialized uses of κριτήριο emerged in Hellenistic epistemology, particularly in connection with the debates about the "criterion of truth" (κριτήριο τῆς ἀληθείας) between the Stoics, Epicureans, and Skeptics. The participants in these debates shared the notion that a criterion of truth was a means of distinguishing with certainty between true and false opinions. The Epicureans and Stoics proposed various candidates for a criterion of truth in this sense, while the Skeptics denied that such a criterion can be found. Epicurus arguably introduced this notion of a criterion of truth by means of an analogy between the κριτήριο and the κανών (the carpenter's rule or straightedge), suggesting the idea of a κριτήριο as something which is itself true (just as the straightedge is itself straight) and so can be used as a means for assessing the truth and falsity of opinions.⁷ Yet another sense of κριτήριο emerges in the course of the debate between the Stoics and the Academic Skeptics, namely, the idea of a criterion as a piece of evidence that warrants belief in the truth of a claim without serving as an indubitable guarantee. This notion is associated with the development of a conception of fallible knowledge by later Academics such as Philo of Larissa.⁸

If we turn to *On the criterion* with this Hellenistic background in mind, a striking difference that emerges is Ptolemy's lack of explicit concern with skepticism. He does

which presents mathematics in general (and mathematical astronomy in particular) as one of the three branches of theoretical philosophy, alongside physics and theology. On Ptolemy and philosophy the most complete account is still Boll 1894, though Feke and Jones 2010 sets the agenda for a reexamination of Ptolemy's philosophy in light of contemporary scholarship.

⁴ Diogenes Laertius (D.L.) 10.27, 7.54; Alcinous, *Didaskalikos* 4, pp. 154.10–156.23 Hermann (for the text see Whittaker and Louis 1990). As Dillon remarks (1993: 61), a discussion of the κριτήριο was "the accepted preliminary to any systematic exposition of logical theory."

⁵ On the various uses of κριτήριο see Striker 1974: 23–33.

⁶ Pl. *Th.* 178b6, *Rep.* 582a6; Arist. *Metaph.* 1063a3.

⁷ For Epicurus' analogy between κριτήριο and κανών see Striker 1974: 31–3.

⁸ On these Academic theories see Striker 1990: 155–60 and Brittain 2001.

not confront any skeptical arguments in the text; rather, he assumes throughout that knowledge is possible and attempts to explain how it can be achieved. On the whole, Ptolemy uses κριτήριο in its general sense of "means of judgment" or "faculty." Yet in giving an account of what he calls "the criterion of the things that are" (τὸ κριτήριο τῶν ὄντων; ch. 1, 3.1), Ptolemy presents a five-part analysis that includes not only the cognitive faculties and processes involved in judgment—νοῦς, αἴσθησις, and λόγος—but also the object that is being judged (identified as "what is," τὸ ὄν) and the aim of judgment (truth or ἀλήθεια). For Ptolemy, then, an account of the κριτήριο is an account of all the elements involved in the process of judgment as well as their interaction; Dillon's "mechanics of making a judgment" captures the idea very well.⁹ As for "what is" (τὸ ὄν), the object of judgment, Ptolemy explains that it plays the role of "subject" (ὑποκείμενον) and "what is judged" (τὸ κρινόμενον), since it is "the clearest (δηλώτατον) and most generic (γενικώτατον) of the things that come under examination" (ch. 2, 4.16–18). Some examples of judgment in the text include: recognizing that a certain perceptible thing is a man or a horse, or an example of health or disease (ch. 11, 17.9–10); judging that "man is the same as horse, qua animal, but different, qua rational" (ch. 11, 17.10–12); grasping "the forms as separated from perceptible things" (ch. 12, 18.1–4); and ascending from particular objects to genera, species, and being (τὸ ὄν) itself (ch. 12, 18.17–19.6). In general, then, Ptolemy's concern is to explain the process by which the human mind can grasp the formal features of perceptible objects and the relations between them.

These features of Ptolemy's account indicate that it has closer affinities to the Platonic and Aristotelian traditions as represented by texts such as the *Didaskalikos* of Alcinous or the description of Peripatetic epistemology in Sextus Empiricus (*Adv. math.* 7.214–7) than to any of the distinctively Hellenistic schools. The similarities with the Peripatetic account are particularly close, as we shall see. This is of course not to say that Ptolemy was ignorant of developments in Hellenistic epistemology. As far as skepticism is concerned, A. A. Long has drawn attention to the way in which

⁹ The phrase περί κριτηρίου is probably best rendered as "On judgment"; cf. Alcinous, *Didask.* 4, p. 154.10–13 Hermann: "Since there is something that judges (τὸ κρινόν), and there is something that is judged (τὸ κρινόμενον), there must also be something that results from these, and that may be termed judgment (κρίσις). In the strictest sense (κυρίως), one might declare "criterion" (κριτήριο) to be the act of judgment (τὴν κρίσιν), but more broadly that which judges (τὸ κρινόν)" (transl. Dillon, slightly modified). In two passages of *On the criterion* (ch. 12, 17.17 and 18.10) Ptolemy refers to sense perception (αἴσθησις) and intellect (νοῦς) as κριτήρια. This should be understood in light of the widespread use of κριτήριο to refer to faculties of the soul, even though these faculties are strictly speaking only elements of the "universal and unqualified κριτήριο" (τὸ καθόλου καὶ ἀπλόον κριτήριο; ch. 1, 3.17–8) whose structure is explained by Ptolemy's five-part analysis.

Ptolemy pursues a strategy of "optimum agreement" in *On the criterion*, emphasizing the common ground between different views and arguing that apparent disagreements concern terminology rather than substance.¹⁰ Such a strategy can be seen as a response to the Skeptics' efforts to appeal to the allegedly irreconcilable disagreement (διαφωνία) between different schools to attack the possibility of knowledge. It should also be viewed against the background of the attempt of later Academics such as Philo of Larissa to identify principles that enjoyed widespread agreement as starting points for (fallible) knowledge in the arts and sciences.¹¹ Nonetheless, it is clear that Ptolemy's explicit purpose in *On the criterion* is not to establish that knowledge is possible, but to explain how it can be attained.

This emphasis may be disappointing if one is interested in the history of skeptical arguments, but it makes good sense if *On the criterion* is viewed in relation to Ptolemy's scientific works. As a practicing scientist who made fundamental contributions across the entire range of the ancient exact sciences, Ptolemy was naturally more concerned with how one goes about judging truth than with the abstract issue of whether or not such judgment is possible. This point has also been emphasized by Long, who characterizes *On the criterion* as offering an "epistemology for the practicing scientist."¹² From this perspective *On the criterion* should be viewed as setting out a basic position on epistemological issues—such as the relative contributions of sense perception and reasoning to scientific knowledge—that are relevant to the methodology employed by Ptolemy in his scientific works. As Long has pointed out, this reading is supported by close parallels between the epistemology of *On the criterion* and the *Harmonics*.¹³ In the opening chapter of the *Harmonics* Ptolemy explains that the two κριτήρια in harmonics are reason (λόγος) and perception (αἴσθησις); the proper use of these two "means of judgment" is a constant theme throughout the work.¹⁴ He distinguishes his approach to the analysis of harmonic intervals from that of the excessively "rationalist" Pythagoreans—for whom rationally justifiable theories should be accepted even when they are directly contradicted by clear evidence of the senses—and that of the overly "empirical" Aristoxeneans, for whom audible harmonies are not subject to rational mathematical analysis at all.¹⁵ This attempt to strike a balance between rationalism

and empiricism corresponds *mutatis mutandis* to the position that Ptolemy advocates in a key passage of *On the criterion*: one should neither dismiss sense perception as irrelevant, nor prefer its conclusions to those of thought (ch. 10, 15.5–8). *On the criterion*, then, may be considered a sort of epistemological prelude to Ptolemy's scientific works.¹⁶

If this view is correct, we should expect the details of the epistemological theory advanced in *On the criterion* to have implications for the understanding of Ptolemy's scientific methodology. I shall return to this point in the conclusion. Before turning to a detailed examination of the text, however, I would like to point out that this view can also help to explain a number of features of *On the criterion* that may seem puzzling at first glance. In particular, *On the criterion* makes no reference to mathematics or demonstration (ἀπόδειξις), a fact which is surprising in light of the central importance of mathematics throughout Ptolemy's scientific work. But the reason for this fact, and for the text's concern with the mind's grasp of forms, becomes clear upon consideration of Ptolemy's general approach to the mathematical sciences as described in the *Almagest* and *Harmonics*. Both texts show that Ptolemy conceives of astronomy and harmonics as attempting to explain the observable behavior of perceptible objects in terms of the relationships between their quantitative, formal features, as expressed in mathematical models (ὑποθέσεις).¹⁷ The forms (εἶδη) do not belong to a separated, Platonic realm, but are underlying features of the objects of study.¹⁸ Thus the harmonicist explains the audible harmonies by reference to the formal, quantitative relationships between different pitches, while the astronomer explains the movements of the observable heavenly bodies by reference to the formal features of the spheres or other bodies on which they are carried (as set out in the mathematical models of epicycles and deferents). Grasping the formal relationships studied by mathematics requires the use of reason (λόγος), which is described in the *Harmonics* as autonomous and orderly (αὐτοτελής, τεταγμένος) in contrast

¹⁶ For argument on partly independent grounds that *On the criterion* is an early work of Ptolemy's, see Feke and Jones 2010.

¹⁷ For ὑπόθεσις in the sense of "model" in Ptolemy see Toomer 1984: 23–4. The term of course has a range of meanings, including "assumption" and "basic principle" on which something else is constructed; cf. Barker 2000: 23–7.

¹⁸ For the analysis of existing things (τὰ ὄντα) into form (εἶδος), matter (ὕλη), and motion (κίνησις) see *Almagest* 1.1, I 5.10–13 Heiberg; *Harm.* 3.3, p. 92.9–11 Düring. The *Almagest* passage states that none of the three can be observed (θεωρηθῆναι) in isolation, though each can be conceived (νοηθῆναι) independently of the others. Ptolemy goes on to contrast the subject matter of mathematics with that of theology and physics: while theology is concerned with the first cause of the primary motion of the universe and physics with "material and ever-changing quality" (τῆς ὁλικῆς καὶ αἰεὶ κινουμένης ποιότητος) such as white and sweet, the subject matter of mathematics is "quality with respect to form and change of position (τῆς κατὰ τὰ εἶδη καὶ τὰς μεταβατικὰς κινήσεις ποιότητος)," such as shape, place, time, and motion (*Almagest* 1.1, I 5.13–6.4 Heiberg).

¹⁰ Long 1989: 165, 171–2.

¹¹ Tarrant 1981.

¹² Long 1989: 163–4.

¹³ Long 1989: 168–70; cf. Bullialdus 1663: 33–5 and Boll 1894: 94–100.

¹⁴ *Harm.* 1.1, p. 3.3–5 Düring: "The means of judgment (κριτήρια) in harmonics are hearing (ἀκοή) and reason (λόγος), but not in the same way: rather, hearing is concerned with matter (ὕλη) and modification (πάθος), reason with the form (εἶδος) and the cause (τὸ αἴτιον)." The chapter goes on to discuss the relationship of αἴσθησις in general to λόγος (below, n. 19).

¹⁵ *Harmonics* 1.1–2; esp. 1.2, p. 5.24–6.13 Düring. Cf. Long 1989: 168–70 and Barker 2000.

to sense perception (αἴσθησις), which is inexact and unreliable insofar as it is bound up with unstable matter.¹⁹ Because of the fallibility and imprecision of sense perception, a mathematical model such as the division of the scale by the harmonic “canon” (κανών) or monochord can serve as a “rational criterion” (λογικὸν κριτήριον), that is, a standard which can assist the senses in making fine discriminations.²⁰ But the primary goal of both the astronomer and the harmonicist is to develop a theory that agrees with the observable phenomena, and it is the “concord” or “agreement” (συμφωνία) between theory and observation that serves as the main criterion of a theory’s truth.²¹ This has the important consequence that theories in astronomy and harmonics cannot be known with demonstrative certainty. To be sure, once a mathematical model has been developed, exact consequences

¹⁹ *Harm.* 1.1, p. 3.1–20 Düring; for the beginning see above, n. 14. Ptolemy goes on to say that λόγος is capable of discovering what is exact (ἀκριβής), while αἴσθησις is limited to the discovery of what is approximate (σύνεγγυς); just as matter is defined (ὀρίζεται) and limited (περιβάλλεται) only by form, so the apprehensions (διαλήψεις) of sense perception are limited and defined by those of reason. Because of the instability (τὸ ἄστατον) of matter, “neither the perception of all people, nor even that of the very same people, remains the same when directed repeatedly to objects in the same condition” (p. 3.17–9 Düring; transl. Barker 1989). The instability of matter is also cited as one reason for the limited reliability of physics in the *Almagest* (τὸ τῆς ὅλης ἄστατον καὶ ἄδηλον, I 6.15 Heiberg).

²⁰ *Harm.* 1.1–2, p. 5.6–13 Düring: “Since similar things occur in relation to sounds and to the hearing, there is needed to help them, just as there is for the eyes, some rational criterion (κριτήριον λογικόν) working through appropriate instruments (διὰ τῶν οὐκείων ὀργάνων), as the plumb line (σταθμὴ) is needed to deal with straightness, for instance, and the compasses for the circle and the measurement of its parts. For the ears.... there is needed some method derived from reason, to deal with the things that they are not naturally capable of judging accurately, a method against which they will not bear witness, but which they will agree is correct. The instrument (ὄργανον) of this kind of method is called the harmonic canon (κανών), a term adopted out of common usage, and from its straightening (κανονίζειν) those things in sense perception that fall short with respect to truth” (transl. Barker 1989, slightly modified).

²¹ Cf. *Harm.* 1.2, p. 5.13–9 Düring: “The aim of the harmonicist would be to preserve (διασῶσαι) in every way the rational hypotheses (ὑποθέσεις) of the canon as never in any way conflicting with sense perceptions according to the judgment of most people, just as the aim of the astronomer (ἀστρολόγος) is to preserve the hypotheses of the heavenly movements in agreement (συμφώνους) with their carefully observed (τηρουμένας) courses, these [hypotheses] themselves being taken from the evident (ἐναργῶν), rough and ready (ὀλοσχερέστερον) appearances, but discovering the particulars (τὰ κατὰ μέρος) by reason as accurately as possible.” Whether the astronomer’s project is defined as “saving the hypotheses” (as here) or “saving the phenomena” (the formulation traditionally ascribed to Plato), the goal is to develop theories that will agree with observation. For the idea of confirmation see *Almagest* 1.8, I 26.9–12 Heiberg: the ὑποθέσεις that have been set out so far will be “completely confirmed and attested (βεβαιωθησομένας καὶ ἐπιμαρτυρησομένας τέλει) by the agreement with the phenomena (τῆς... πρὸς τὰ φαινόμενα συμφωνίας) of the things that will be demonstrated sequentially in what follows.” That agreement with observation is a more important criterion of the truth of a theory than derivability from rational principles is apparent from *Almagest* 9.2 (II 211–12 Heiberg), where Ptolemy indicates that his planetary theories will feature “basic assumptions which we arrived at not from some readily apparent principle, but

can be drawn from it using the indisputable methods of arithmetic and geometry. But the process of building the model involves a significant empirical component; hence its accuracy is necessarily affected by the imprecision of sense perception. Moreover, deciding when a theory qualifies as agreeing with observation is a delicate matter that involves judgment and requires assessing whether observations fall within an acceptable margin of error.²² Finally, Ptolemy explicitly recognizes that there may be more than one model that agrees with the observable phenomena; hence agreement with observation does not *imply* the model’s truth.²³ The upshot is that Ptolemy’s conception of method in the exact sciences gave him good reason to conceive of theories in disciplines such as astronomy and harmonics as fallible, even though they make as much use as possible of deductive methods.²⁴ The agreement between theory and observation is a criterion in the sense of being a reliable indication of the theory’s truth; it is not an indubitable guarantee.²⁵

The close connection between reason, form, and mathematics in Ptolemy’s thought explains the emphasis on form and the apparently puzzling lack of any reference to mathematics or demonstration in *On the criterion*. What the text addresses is the

from a long period of trial and application” (κατὰ τὴν συνεχῆ διάπειραν καὶ ἐφαρμογὴν, II 212.3–5 Heiberg; transl. Toomer 1984). The paradigm example is the introduction of the equant point, according to which the center of uniform rotation is assumed to be different from the geometrical center of some of the circles in the planetary models. The justification of such features consists precisely in the fact that their consequences agree with the phenomena.

²² On the question of observational error in Ptolemy see Lloyd 1982; cf. Grasshoff 1990: 211.

²³ See, for example, Ptolemy’s proof of the empirical equivalence of the epicyclic and eccentric models of the solar motion in *Almagest* 3.3, I 219–32 Heiberg. The idea that agreement with observation does not serve as a demonstration of a theory’s truth has a long subsequent history; cf. Aquinas, *Summa Theologica* 1.32. As Musgrave has shown (1991), Ptolemy’s recognition of this point in no way commits him to an instrumentalist position along the lines set out by P. Duhem (1969).

²⁴ At *Almagest* 1.1, I 6.11–21 Heiberg Ptolemy says that both physics and theology should properly be called “conjecture” (εἰκασία) rather than knowledge, and that there is no hope that philosophers will ever agree about them; mathematics, however, can provide firm (βέβαιαν) and unshakable (ἀμετάπστον) knowledge, “for its kind of proof (ἀπόδειξις) proceeds by indisputable (ἀναμφισβητητῶν) methods, namely arithmetic and geometry.” But while Ptolemy obviously prizes the reliability of mathematical demonstration and makes extensive use of deductive methods in his scientific works, those works are not organized to conform to the ideals of either Aristotelian demonstration or Euclidean axiomatics (cf. Suppes 1980). In general, Ptolemy’s position seems to be that sciences such as astronomy and harmonics should make use of arithmetic and geometry as tools (they are “instruments of indisputable (ἀναμφισβητήτοις) authority”; *Harm.* 3.3, p. 94.16–17 Düring), while also recognizing the limits of what they can reveal about the physical world. Barker (2000: 15) emphasizes Ptolemy’s recognition of the fallibility of his scientific theories.

²⁵ Although Ptolemy does not say that συμφωνία is a κριτήριον, his position amounts to a recognition that it serves as a criterion of truth of scientific theories in the weaker sense that emerges from the Stoic/Academic debate (above, n. 8).

general issue of how the mind grasps forms and uses its cognitive faculties in the judgment of truth. Its concern is to explain the contributions of the senses and the intellect to this process, without going into the details of the nature of reasoning in a discipline such as geometry or arithmetic, or the method of building a mathematical model from empirical data in astronomy or harmonics. The emphasis is not on the certainty that can be achieved through demonstration, but on the issues involved in developing theories from observations and assessing their truth. In sum, what *On the criterion* provides is not a scientific method as such, but an epistemological theory on the basis of which scientific methods can be developed. By understanding the way in which the human mind grasps truth and the epistemological basis of reliable judgment, Ptolemy suggests, the scientist will better be able to develop suitable methods to reach the truth about the world in particular areas of investigation.

With these considerations in mind, I turn to a close examination of the epistemological theory set out in *On the criterion*. My principal goal is to show how Ptolemy draws on the philosophical tradition to formulate a theory of knowledge that addresses the issues raised by his work in the exact sciences. In the conclusion I will summarize some of the distinctive aspects of Ptolemy's epistemology and briefly consider some of its implications for the understanding of his scientific method.

2.

The most striking feature of Ptolemy's procedure in *On the criterion* is the extended analogy he draws in chapters 1–3 between the κριτήριο and the lawcourt or δικαστήριο—where this is understood not as a place, but as a body of individuals (the assembly or the jury) that renders judgment. The analogy was supported by the fact that the term κριτήριο was regularly used to refer to the lawcourt in Hellenistic Greek.²⁶ As far as we know, however, Ptolemy is the first thinker to develop the analogy in detail. He frames his approach in terms of an Aristotelian progression from particulars to universals:

We would investigate the means of judging the things that are (τὸ κριτήριο τῶν ὄντων) in the necessary way if we were to compare it to some of the means of judgment (κριτηρίοις) that are specifically arranged under it. For the most natural preliminary approach to all universals is through the particulars which fall under the same genus. (ch. 1, 3.1–5)

²⁶ E.g. Polybius 9.33; cf. Debrunner 1954: 56. Plato, *Laws* 767b seems to be the only pre-Hellenistic example of the use of the term in this sense.

That the universal is grasped by starting from the particular is of course well-established Aristotelian doctrine.²⁷ But Ptolemy's procedure is interesting in that he takes the lawcourt to be both an example of the genus κριτήριο and an analog for the general class. Moreover, the analogical approach is not just an expository device; it is in fact how Ptolemy thinks one can best grasp the structure of the κριτήριο. With this opening Ptolemy signals that an understanding of the κριτήριο is to be reached not by deduction from first principles but by reflecting on examples of how judgment is actually carried out.

Ptolemy begins his exposition of the lawcourt analogy by presenting a general picture of legal judgment: a judge or magistrate (ὁ ἀρχων) renders judgment on a matter of dispute, for example, an act (πράξις), which is “made manifest in a certain way” (δηλωθεῖσάν πως) during the court proceedings. The magistrate judges by “following the law” (ἀκολουθῶν νόμῳ), and with the goal of civic association (κοινωνία) in mind.²⁸ From this example Ptolemy derives a five-part analysis of the elements of judgment, which is applied to judgments with technical instruments and to the case of judgment in general (Table 13.1). As set out in column 1 of Table 13.1, these elements are: (1) what is judged (τὸ κρινόμενον), (2) that through which (δι’ οὗ) it is judged, (3) that which judges (τὸ κρίνον), (4) that by which (ᾧ) it is judged, (5) and that for the sake of which (οὗ ἕνεκεν) it is judged. Applying this schema to the case of legal judgment yields the correspondences set out in column 2 of the table: what is judged (τὸ κρινόμενον) is the act (πράξις), that “through which” (δι’ οὗ) it is judged is the “presentation” (δήλωσις) of the case, that which judges (τὸ κρίνον) is the magistrate (ὁ ἀρχων), that “by which” (ᾧ) it is judged is the law (νόμος), and that “for the sake of which” (οὗ ἕνεκα) judgment is rendered is civic association (κοινωνία).²⁹ In the general case of judgment by the human mind (column 4), intellect (νοῦς) is the judge; it seeks to grasp “what is” (τὸ ὄν) for the sake of truth (ἀλήθεια), and it does so “through” sense perception (αἴσθησις) and “by” reasoning (λόγος).

The relationship between the first, third, and fifth elements in Ptolemy's scheme is clear enough. Any act of judgment involves a judge (τὸ κρίνον) and something that is

²⁷ See e.g. A. Po. B 19, 100a 4–b 5; *Metaph.* A 1, 980a 27–981a 12.

²⁸ Ptolemy's model of the judicial process—involving a single magistrate, the reading of legal documents, courtroom speeches, and examination of witnesses—corresponds reasonably well to what we know of legal practices in Greco-Roman Egypt in the second century AD. On these see Taubenschlag 1916; Kelly 2011: 170–77 and *passim*.

²⁹ Ch. 1, 3.10–14.3. The tabular arrangement is a convenient way to present Ptolemy's criterial scheme, though the text makes no reference to a table. In some manuscripts, however, the text of *On the criterion* is followed by a table that sets out various ways of filling out Ptolemy's scheme for different types of judgment (Lammert 1961: 24–5; Huby and Neal 1989: 227–30).

Table 13.1 Ptolemy's analysis of the elements of judgment

Elements of judgment	Legal judgment	Judgments with technical instruments	Judgment in general
1 what is judged (τὸ κρινόμενον)	act (πράξις)	magnitude (μέγεθος)	what is (τὸ ὄν)
2 that through which (τὸ δι' οὗ)	presentation of case (δήλωσις)	cubit-rule (πῆχυς)	sense perception (αἴσθησις)
3 that which judges (τὸ κρίνον)	magistrate (ἄρχων)	surveyor (ἀναμετρητής)	intellect (νοῦς)
4 that by which (τὸ ὅ)	law (νόμος)	application of rule (ἐπιβολή, παραβολή)	reasoning (λόγος)
5 that for the sake of which (τὸ οὗ ἕνεκα)	civic association (κοινωνία)	size (πληκότης)	truth (ἀλήθεια)

judged (τὸ κρινόμενον); it can also be said to aim at some goal (τὸ οὗ ἕνεκα).³⁰ The main difficulty is understanding the roles of the second and fourth elements; since these correspond to sense perception (αἴσθησις) and reasoning (λόγος) in the general case, it is crucial to define their roles precisely. One way to approach this problem is to try to understand the semantic value of the two expressions that Ptolemy uses to designate these elements, the "through which" (διά + genitive) and "by which" (dative) locutions.³¹ The preposition διά followed by the genitive case can be taken in a spatial or temporal sense (as when something moves "through" a distance or period of time) but also as expressing the means or instrument "through which" something is done (LSJ s.v. I, III). In the legal case, the advocates' presentation of the case provides the judge with access to events that he has not witnessed; it thus conveys information "through" distances in time and space. But the case of measurement (column 3) emphasizes the instrumental role of the second element, since that element corresponds to the measuring instrument (the πῆχυς or cubit-rule). As for the fourth element, that "by which"

³⁰ That Ptolemy identifies civic association (κοινωνία) as the goal of legal judgment reflects the role of the lawcourt as a forum for settling disputes and sustaining the civic order. For a view of the social function of the legal system in Greco-Roman Egypt see Kelly 2011.

³¹ This approach is inspired by Burnyeat's analysis of the distinction between that "through which" (διά + genitive) and that "by which" (dative) we perceive in Pl., *Tht.* 184–86 (Burnyeat 1976). The passage is an obvious model for Ptolemy's usage, whether directly or via the Platonic tradition.

(ὅ) judgment is rendered, the dative can also express the idea of means or instrument. But Ptolemy's picture of legal judgment, in which the judge judges by "following the law" (ἀκολουθῶν νόμῳ), suggests interpreting the dative as modal, that is, as expressing the character of the action that is involved in judgment. This is supported by the example of measurement (col. 3), in which the fourth element corresponds to the way in which the rule is applied (by being placed alongside or on top of what is to be measured). Now in one sense, "following the law" might be understood as the application of procedures for evaluating the evidence presented in court. But the law can also be conceived of as a standard or norm, that is, as something by comparison with which the rightness of actions is assessed.³² This suggests understanding the fourth criterial element as that "by reference to which" one judges, where the operation of "referring" is understood as comparison to a standard or norm.³³

Ptolemy gives two additional instrumental examples to illustrate his scheme, involving judgments of weight and judgments of perpendicularity or straightness (ch. 1, 4.3–14; Table 13.2). Taken together with the measurement example, these support the interpretation of the fourth element as expressing both the mode or manner of judgment and, more specifically, the comparison to standards. In the case of the cubit-rule, the straightedge, and the plumb line, the fourth element corresponds to the application of the instrument (e.g., placing the rule alongside the object to be measured). But in the case of the balance, the fourth element is not its application but rather the result of that application, the inclination (ρόπή) of the balance one way or another. It is by reference to this inclination that one can decide which of the two weights is greater. In fact the application of the other instruments also involves a similar comparison. A wall, for example, is assessed for straightness or perpendicularity by comparison to the straightedge or plumb line; similarly, measurement by the cubit-rule involves comparison between the length to be measured and the length of the standard rule. The difference between these instruments and the balance is simply that the former are themselves standards (of length, straightness, or perpendicularity) while the balance is not. In sum, then, the fourth element refers to the use of the second to yield a result, by reference to which a reliable judgment is made.³⁴

³² For the analogy between law (νόμος) and κανὼν as rule or norm see Oppel 1937: 51–7. Cf. Dio Chrysostom 75.1: law is "the just straightedge (κανὼν δικαιοῦς), against which (πρὸς ὃν) each person must straighten (ἀπευθύνειν) his own character."

³³ For the dative cf. Pl. *Rep.* 582a (cited by Smyth [1956: sec. 1512] as an example of the "dative of standard of judgment") and Gal. *De opt. doct.* 1.43.21–44.2 Kühn: some have taught that man has no κριτήριον "by comparison with which he will discern each of the things that are with precision" (ὅ παραβάλλων ἕκαστον τῶν ὄντων ἀκριβῶς διαγνώσεται).

³⁴ If Ptolemy's fourth element expresses the idea of a standard of judgment, it might seem puzzling that the κανὼν and σταθμὴ are identified with the *second* element. But I take it that they are

Table 13.2 Ptolemy's elements of judgments illustrated by analogies with measuring instruments

Elements of judgment	Magnitude	Weight	Perpendicularity, straightness
1 what is judged (τὸ κρινόμενον)	magnitude (μέγεθος)	weight (βάρος)	state, placement (σχέσις, θέσις)
2 that through which (τὸ δι' οὗ)	cubit-rule (πῆχυς)	balance (ζυγόν)	plumb line, straightedge (σταθμὴ, κανὼν)
3 that which judges (τὸ κρίνον)	surveyor (ἀναμετρητής)	weigher (ζυγοστάτης)	builder, carpenter
4 that by which (τὸ ὅ)	laying alongside/on (παραβολή, ἐπιβολή)	inclination (ρόπή)	placing alongside, extending (παράθεσις, ἀπότασις)
5 that for the sake of which (τὸ οὗ ἕνεκα)	quantity of magnitude (ἡ πηλικότης τοῦ μεγέθους)	excess of weight (ἡ ὑπεροχὴ τοῦ βάρους)	perpendicularity, straightness (ὀρθότης, εὐθύτης)

A similar appeal to the instrument analogy to express a distinction between agent, instrument, and use is found in Sextus Empiricus' presentation and refutation of theories of the criterion in *Adv. math.* 7. At 7.35–7 Sextus explains that the term κριτήριον as applied to a means of judging truth can be understood in several senses, which he explains by analogy to the use of technical instruments such as the balance. Just as the process of weighing involves a weigher, a balance, and the application of the balance, so the κριτήριον can be understood as (a) that “by the agency of which” (δι' οὗ) judgment takes place (e.g. man), (b) that “through which” (δι' οὗ) it takes place (e.g. αἴσθησις or διάνοια), and (c) “application and mode” (προσβολὴ καὶ σχέσις). An example of the third sense is the application of an impression (προσβολὴ τῆς φαντασίας), “according to which” (καθ' ἣν) the man judges. The same division is found in *Pyrr. hyp.* 2.15, except that the phrase “according to which” (καθ' ὃ) is used in place of προσβολὴ καὶ

identified with this element qua instruments, not qua standards; i.e. it is irrelevant to the role of the κανὼν as that “through which” judgment is reached that the straightedge is itself straight. For the idea of the κανὼν and σταθμὴ as instruments whose use provides a standard of assessment cf. *Harm.* 1.1–2, p. 5.6–13 Düring (above, n. 20).

σχέσις. The distinctions that Sextus draws correspond closely to those that underlie the second, third, and fourth elements in Ptolemy's criterial scheme. Like Ptolemy, Sextus distinguishes between criterial instruments (expressed by the phrase δι' οὗ) and their application to yield a result “according to which” or “in virtue of which” judgment is made. For Sextus the result of applying the instruments is an impression (φαντασία). In Ptolemy's picture, the result of applying the instrument is (e.g.) the inclination (ρόπή) of the scales, or the correspondence/lack of correspondence between a standard length and a length to be measured.

I shall return to the significance of the parallel with Sextus at the end of this section. But we can now pause to offer a preliminary analysis of the contrast between the second and fourth elements in Ptolemy's scheme. The example of legal judgment suggests a contrast between the source of information (the presentation of evidence in court) and the methods and standards for evaluating it (the law). The instrument analogy suggests a contrast between instruments and their use to reach results on which secure judgment can be based. This perspective can readily be applied to the legal case: the evidence is “used” by considering it in light of the law, which yields a result in virtue of which the decision is made; the whole process can be described as “following the law.” Thus, Ptolemy's identification of αἴσθησις with the second criterial element and λόγος with the fourth (col. 4 in Table 13.1) can be understood as follows: sense perception functions as a source of information (like the evidence provided in court) and λόγος as a way of using that information to reach a result “by reference to which” judgment can be made. In other words, αἴσθησις supplies the raw information, while λόγος provides the methods of assessment and standards of judgment.

Now since in Ptolemy's scheme the agent of judgment (τὸ κρίνον) is the intellect (νοῦς), both sense perception and λόγος can also be viewed as instruments that the intellect uses in different ways. Ptolemy builds this perspective into his exposition of the lawcourt analogy as well. In chapter 2 he explains that the first and fifth elements of his criterial scheme are “extremes” (ἄκρα), which can immediately be identified with “what is” (τὸ ὄν) (as “the most generic subject of investigation”) and with truth (since all investigation aims at truth; 4.15–5.3). The middle position between the extremes is occupied by the third element, the agent of judgment, which is a source or principle (ἀρχή); surrounding it are the second and fourth, “like instruments” (περιοχὴ δὲ καὶ ὥσπερ ὄργανα, 5.4–6). Later in the chapter (5.15–18) Ptolemy offers another characterization in which the first, third, and fifth elements are said to be “limits” (ὅροι) and “extremities” (ἀκρότητες) which are “simple” and “unmixed in their nature,” while the second and fourth are the “interval” (διάστημα) and “means” (μεσότητες), “like conveyors in their transmissions to the extremes” (ὥσπερ πορισται κατὰ τὰς πρὸς τὰ ἄκρα διαδόσεις). Sense perception (αἴσθησις) mediates between τὸ ὄν and the intellect (presumably by providing sensory evidence that reveals information about the objects of

judgment) while reasoning (λόγος) mediates between the intellect and truth (presumably by making use of the evidence of the senses in such a way as to reveal the truth). The upshot of these characterizations is that the contrast between the second and fourth elements—and so between αἴσθησις and λόγος—can be described as a contrast between different kinds of instrumentality. This of course is supported by the fact that both the “through which” (δι’ οὗ) and “by which” (ᾧ) locutions can express the idea of means or instrument.

Ptolemy goes on to provide a more detailed account of the operation of both αἴσθησις and λόγος, based on a division between the perceptive and rational elements of the soul (ch. 2, 5.18–6.11). The perceptive faculty (αἰσθητικὴ δύναμις) includes the sense organs (τὰ αἰσθητήρια), which are “the instruments (ὄργανα) of the body through which (δι’ ὧν) it grasps (ἅπτεται) perceptible things”; φαντασία, the “impression (τύπωσις) and transmission (διάδοσις) to the intellect”; and ἔννοια or “conception,” the intellect’s retention (κατοχή) and memory (μνήμη) of what has been transmitted to it (τῶν διαδοθέντων). These abilities are shared by other animals as well as human beings. The principal activity of the rational part of the soul (τὸ λογικόν), which is distinctive to humans, is thought (διάνοια), defined as “internal reason (ὁ λόγος ὁ ἐνδιάθετος), a kind of exposition (διέξοδος) and recalling (ἀναπόλησις) and discrimination (διάκρισις) of what has been remembered” (6.3–5). The identification of λόγος with thought conceived of as a kind of internal conversation echoes Platonic formulations in the *Sophist* and *Theaetetus*, and shows that what Ptolemy means by λόγος is not a faculty but a process of rational discourse.³⁵ Corresponding to the internal λόγος of thought is external or “expressed” (προφορικὸς) λόγος, which is conveyed in speech (διάλεκτος). Ptolemy further distinguishes between the “simple and undifferentiated” (ἀπλῇ καὶ ἀδιάρθρωτος) use of internal λόγος, which becomes opinion (δόξα, οἵσις), and its “systematic and unshakeable” (τεχνικὴ, ἀμετάπειστος) application, which becomes knowledge (ἐπιστήμη).

This highly compressed account of the various stages on the path from sense perception to knowledge leaves many issues open, but several points at least are clear. (1) The senses are viewed as providing access to the external world “through” the sense organs (διὰ in its spatial sense), thus supporting the assignment of αἴσθησις to the second element in the criterial scheme. (2) The conception of λόγος as a process rather than a faculty clarifies the way in which the intellect can be said to “use” sensory evidence by means of λόγος: the impressions (φαντασίαι) of the senses are retained in memory and analyzed through the process of discursive reasoning. (3) The senses are portrayed simply as conveyors of information—“impressions” or φαντασίαι—which

are passed along to the intellect through a process of “transmission” (διάδοσις). There is no suggestion that the formation of φαντασίαι might involve anything more than the “stamping” (τύπωσις) of an external object on the sense organs; similarly, the genesis of ἔννοια from φαντασίαι is apparently identified with their “retention” (κατοχή) in memory. As Boll noted, there is a close parallel to Ptolemy’s account of concept formation in Sextus’ account of Peripatetic philosophy at *Adv. math.* 7.217–26.³⁶ But unlike Ptolemy, the Peripatetics distinguish between ἔννοια and μνήμη; the former is described as the “collection of impressions (φαντάσματα) of the intellect (νοῦς)” and a “summing up of particulars towards the universal” (συγκεφαλαίωσις τῶν ἐπὶ μέρος εἰς τὸ καθόλου; *Adv. math.* 7.224). In this picture ἔννοια corresponds roughly to what Aristotle calls “experience” or ἐμπειρία in his own accounts of concept formation.³⁷ There is reason to suppose that Ptolemy held a similar view, which might have emerged in a fuller account.³⁸ Nonetheless the effect of his abbreviated description is to emphasize the role of the senses as conveyors of information that is not altered in the process of transmission. (4) Finally, despite the fact that Ptolemy assigns ἔννοια to the perceptive rather than the rational part of the soul, his account also suggests that the content of ἔννοια can be expressed in language via λόγος. At 6.6–9 he draws a striking analogy: as νοῦς stands to φθόγγος (“sound”), so ἔννοια stands to φωνή (“voice”), and διάνοια to διάλεκτος (“speech”). φωνή (“the sound of the voice, whether of men or animals,” LSJ s.v.) is distinct from both undifferentiated sound (φθόγγος) and articulate speech (διάλεκτος). Similarly ἔννοια is distinct from both νοῦς (here conceived of as potential rather than active intellect) and from the articulate, rational discourse that is Ptolemy’s internal λόγος.³⁹ By situating ἔννοια along a spectrum of increasing differentiation and

³⁶ Boll (1894), 79–82. Both Ptolemy and Sextus discuss αἴσθησις, φαντασία, νοῦς, ἔννοια, μνήμη, διάνοια, δόξα, and ἐπιστήμη. Further parallels include the identification of αἴσθησις and νοῦς as “primary criteria” (πρῶτα κριτήρια; cf. ch. 12, 17.17) and an appeal to the instrument analogy in which νοῦς plays the role of craftsman (τεχνίτης) and αἴσθησις that of instrument (ὄργανον) (*Adv. math.* 7.226).

³⁷ *Metaph.* A 1, 980a27–981a12; A. Po. B 19, 100a4–b5.

³⁸ For a Stoic (or Stoicizing) account associating ἔννοια with ἐμπειρία see SVF 2.83 (= Aetius 4.11). Dillon (1993: 68) notes that Alcinous sometimes identifies memory with the result of the preservation of sense impressions (e.g. *Didask.* 4, p. 154.39–40 Hermann) and sometimes treats it as a synonym of φυσικὴ ἔννοια, “natural concept” or “natural concept-formation” (ch. 4, p. 155.34 Hermann). This is no contradiction, however, since “For A., memory’s activity in preserving and ‘collating’ sense impressions also serves to give us an intuition of the forms as they are manifested in matter.” Similarly, Ptolemy says that it is “through the memory extended from perceptible things” (κατὰ τὴν διατεινομένην ἀπὸ τῶν αἰσθητῶν μνήμην) that one comes to grasp the forms as separated from particulars (ch. 12, 18.1–4; see the discussion of this passage below).

³⁹ Cf. Arist. *HA* 535a26–31: φωνή is ascribed to animals while διάλεκτος is defined as “the articulation of voice by the tongue” (ἡ τῆς φωνῆς τῇ γλώττῃ διάθρῳσις); both are distinguished from mere sound (ψόφος).

³⁵ Pl. *Soph.* 263e, *Th.* 189e–190a; cf. Alcinous, *Didask.* 4, p. 155.17–20 Hermann.

articulation, Ptolemy's analogy suggests that an *ἐννοια* has the potential to be expressed in language. And since an *ἐννοια* on the present account is simply the retention of *φαντασῖαι* in memory, the analogy suggests that the content of sense impressions can be expressed in language as well. This will be confirmed in the sequel.

In chapter 3 Ptolemy returns to the lawcourt analogy and extends it to include the cognitive faculties, processes, and states described in chapter 2 (6.12–7.6). *αἰσθησις* is now said to correspond to the advocates, while the sense organs correspond to the memoranda or petitions (*ὑπομνήματα*) filed by the litigants,⁴⁰ *φαντασία* to the speeches given in court (*αἱ ῥητορεῖαι*), and *ἐννοια* to the “memory and writing down of what has been said” in court (*μνήμη καὶ ἀναγραφὴ τῶν ῥηθέντων*). Just as the faculty of sense perception makes use of the sense organs to fashion its impressions (*φαντασῖαι*) on the intellect, so the advocates make use of *ὑπομνήματα* in fashioning their speeches in court. The distinction between *ὑπομνήματα* and complete speeches might be a hint that *φαντασία* involves a certain amount of embellishment;⁴¹ similarly, the analogy between *ἐννοια* and the writing down of the speeches could suggest that the process of forming *ἐννοια* involves a certain amount of summary or generalization. In any case, the comparison of *φαντασία* with courtroom speeches suggests that *φαντασῖαι* are rich representations of perceptible objects, the contents of which can be expressed in language by *λόγος*. Finally and most importantly, the comparison of sense perception to the advocates and *φαντασία* to their speeches conveys the partisan character of sensory evidence: the reports of the senses are like representations fashioned by the advocates to support a certain point of view.⁴²

For all its complexity, Ptolemy's lawcourt analogy is an effective means of clarifying the relationship between the different aspects of human judgment. In this picture intellect or νοῦς is the authoritative judge; it pronounces judgment by assessing the evidence of the senses in the light of rational discourse (*λόγος*). The senses provide the evidence that gives the intellect access to what is to be judged. But the impressions they produce

⁴⁰ *ὑπόμνημα* is regularly used of a petition addressed to a magistrate in Greco-Roman Egypt; cf. LSJ s.v. IV. In a legal context such petitions typically detailed the complaints of the petitioner and so could serve as the basis of the advocates' speeches. Kelly (2011: 172–5) draws attention to the significant overlap of terminology and rhetorical *topoi* between the text of petitions and courtroom speeches.

⁴¹ *φαντασία* is said to involve representation or depiction (*ἀναζωγράφησις*) in Alcinoüs (*Didask.* 4, p. 155.13–17 Hermann); cf. *ἀναζωγραφῇ* at Sextus, *Adv. math.* 7.222.

⁴² At 6.19–7.1 internal *λόγος* is likened to “the consultation and achievement of the judgment (*τὸ συμβούλιον καὶ τέλος τῆς γνώμης*)” and expressed *λόγος* to “the sentence and announcement of the judgment (*τῇ ἀποφάσει καὶ ἀνακηρύξει τῆς κρίσεως*).” This seems inapposite, insofar as expressed *λόγος* (i.e. language) seems to be a medium of deliberation as much as internal *λόγος*. But Ptolemy consistently emphasizes the superiority of internal to expressed *λόγος*; the latter, he claims, can easily lead to distraction and error (e.g. ch. 5, 8.13–20). The restriction of external *λόγος* to the

on the intellect, like the speeches of advocates in court, are partisan and not objective. The intellect must evaluate or “use” them by a process of reasoning (*λόγος*), just as the judge must evaluate the speeches of the advocates by following the procedures of the law (*νόμος*). Like the law, *λόγος* supplies the methods of evaluation and standards by which the evidence is assessed. Thus both *αἰσθησις* and *λόγος* are instruments employed by the intellect, though they function in different ways—the first as providing information, the second as a means of evaluating it. The various contrasts that Ptolemy draws between the second and fourth elements of the criterial scheme—between source of information and means of evaluation, instrument and use, or different kinds of use—are all captured by the “through which” (*δι’ οὗ*) and “by which” (*ὧ*) locutions. Finally we may note that the lawcourt analogy suggests that both sense perception and reasoning are essential for gaining knowledge of the nature of things: without the senses the intellect has no access to the world, and without reasoning, it has no means of assessing what the senses report. But the power of judgment lies with the intellect and its use of *λόγος* rather than the senses.

Before turning to the further development of these ideas in chapters 4–12 of the text, I would like to return to the comparison between Ptolemy and Sextus. While a number of roughly contemporary authors advocate criterial schemes that correspond to elements of Ptolemy's, Sextus' tripartite division between agent, instrument, and mode of application is by far the closest parallel.⁴³ This is potentially significant for the understanding of Ptolemy's argumentative strategy. There is reason to think that Sextus' tripartite division originated in a Skeptical context, since a passage in Diogenes Laertius suggests that the three aspects of judgment that Sextus identifies were discussed by certain skeptics as alternative candidates for being the criterion of truth.⁴⁴ It is certainly the case that the scheme functions in this way in Sextus' text. In his refutation of the existence of a criterion of truth he proceeds systematically through the three aspects as though they were alternatives: neither can man be the criterion (*Adv. math.* 7.263–342); nor can sense perception and intellect, whether working separately or together (7.343–69); nor can *φαντασία*, whether “cognitive” or only “plausible”

announcement of the decision may be meant to emphasize that the only true deliberation is the internal deliberation of thought. In any case the characterization of internal *λόγος* confirms the role of the fourth criterial element as including both the process of reaching a judgment (the deliberation or consultation, *συμβούλιον*) and the result (*τέλος*) of that process.

⁴³ According to D.L. 1.21, the “eclectic” philosopher Potamon of Alexandria distinguished between the criterion of truth “by the agency of which” (*ὅφ’ οὗ*) judgment comes about (the commanding faculty or *ἡγεμονικόν*) and that “through which” (*δι’ οὗ*) it comes about, identified as “the most exact impression (*τὴν ἀκριβεστάτην φαντασίαν*).” Alcinoüs distinguishes between the agent (*ὅφ’ οὗ*) of judgment (the human intellect, νοῦς), and that “through which” (*δι’ οὗ*) judgment comes about, viz. a “natural instrument of judging” (*δργανον φυσικὸν κριτικόν*) that is identified with natural or innate reason (*λόγος φυσικός*) (*Didask.* 4, p. 154.10–18 Hermann).

⁴⁴ D.L. 9.95; cf. Striker 1974: 69–70.

(7.370–439). The tripartite division thus serves Sextus as a means of organizing his refutation of many different theories of the criterion. Ptolemy adopts the same division but for the opposite purpose: to show that his theory of the κριτήριον captures the key elements of judgment common to other views, and so rests on a basis of wide agreement. In this way, Ptolemy turns a strategy of refutation to a strategy for commanding assent.⁴⁵

3.

The remainder of the epistemological section of *On the criterion* (chapters 4–12) is concerned with clarifying the relative contributions of intellect (νοῦς), sense perception (αἴσθησις), and rational discourse (λόγος) to scientific knowledge. Ptolemy builds on the picture developed in the lawcourt analogy, although he largely drops the analogical mode of exposition. The basis of the account is the traditional distinction between sense perception and intellect. At the beginning of chapter 4 Ptolemy remarks that νοῦς and αἴσθησις are “principles of a kind, and elements” (ἀρχαί τινες καὶ στοιχεῖα), while the other aspects of the soul involved in judgment are “faculties (δυνάμεις) and organs (ὄργανα) and activities (ἐνεργήματα)”; hence a grasp of the similarities and differences of perception and intellect will be sufficient to clarify all the relevant issues (7.7–11).⁴⁶

After a largely methodological interlude that emphasizes the need to avoid empty terminological disputes (ch. 4–8, 7.12–13.3) Ptolemy returns to epistemology proper. In chapters 8 and 9 (13.4–15.4) he offers a detailed comparison between sense perception and intellect that emphasizes the superiority of the latter. The key points of this comparison are as follows. (1) Ptolemy draws a sharp distinction between the functions of sense and intellect. Sense perception is conceived of as a messenger (ἄγγελος) that grasps perceptible things (αἰσθητά) through the sense organs and “transmits to the intellect by way of impression the affections that arise in it” (διαδίδωσι κατὰ τὴν φαντασίαν τὰ γινόμενα περὶ αὐτὴν πάθη τῷ νῷ). The intellect adds (ἐπισυνάπτει) the activity of thought and critical judgment (τὴν διανοητικὴν καὶ κριτικὴν ἐνέργειαν; ch. 8, 13.5–10). The senses judge (κρίνειν) how they themselves are affected (i.e. their πάθη), while the intellect judges both the external objects (ὑποκείμενα) that produce the affections and

the faculty of sense perception itself (ch. 8, 13.12–16).⁴⁷ (2) At the same time, perception and intellect need to work together: “there is perception and thought of the same things, but not in the same way” (ch. 8, 13.10–12). The picture of sense perception as a messenger implies that the intellect can receive and work on the message; for Ptolemy, therefore, the category of the intelligible (νοητόν) includes the transmissions of αἴσθησις once they have been received and processed by the intellect.⁴⁸ (3) The senses can grasp their objects independently of the intellect, but only when those objects are actually present or at slight remove. By contrast, the intellect is dependent on the senses for its first impressions of things in the world; once it has received those impressions, however, it retains them in memory even when they are no longer present, to such an extent that it might seem to have generated its initial conception (τὴν πρώτην ἐννοιαν) of things on its own (ch. 8, 13.16–14.3). (4) Even if the intellect's first encounter with things in the world takes place through the senses, it has an independent power of thought and judgment. Sense perception, by contrast, needs to be affected (παθεῖν) in order to perceive the same things; moreover it is often affected in opposite ways by the same things, and in the same way by opposite things (ch. 9, 14.23–15.4). (5) Finally, in chapter 9 Ptolemy offers a teleological argument in support of the superiority of the intellect and its characteristic activity of rational thought (τὸ διανοεῖσθαι) to sense perception (14.4–21). In potentiality (δυνάμει), intellect is neither prior nor posterior to sense perception; but in actuality (ἐνέργεια) sense perception is prior. This is because it is present in imperfect (ἀτελής) creatures which cannot engage in rational thought at all, and develops first in those which can (14.4–16). But precisely because it is the first to develop, and because the capacity for sense perception is shared more widely among living things than the capacity for rational thought, Ptolemy infers that the latter is more honorable (τιμιώτερον; 14.16–21).

Throughout this account Ptolemy's emphasis is on the greater autonomy and reliability of thought in contrast to sensation; his sole concessions to the senses are that they develop before the intellect (which is in any case not a mark of honor in his view) and that the intellect is dependent on them for its initial grasp of objects in the world. Just as we would expect from the lawcourt analogy, the senses are conceived of as a source of information about external objects, but the power of judgment belongs to

⁴⁵ The fact that Potamon was known for “selecting his doctrines from each of the schools” (ἐκλεξαμένου τὰ ἀρέσκοντα ἐξ ἐκάστης τῶν αἰρέσεων, D.L. 1.21) suggests that one motivation for the introduction of such criterial schemes was to clarify the common basis of apparently divergent theories.

⁴⁶ For αἴσθησις and νοῦς as principles or “primary criteria” (πρώτα κριτήρια) see Sextus, *Adv. math.* 7.217–8, 226; Alcinous, *Didask.* 4, p. 154.32–4 Hermann.

⁴⁷ The distinction between ὑποκείμενα and πάθη is traditional in Hellenistic epistemology; cf. Sextus, *Adv. math.* 7.195, 7.365; Gal. *De dignos. puls.* 1.5, 8.793 Kühn (= SVF 2.79). For τὸ ἐκτὸς ὑποκείμενον = αἰσθητόν see *Adv. math.* 9.352 (= SVF 2.80).

⁴⁸ Noted by Boll (1894: 80 and n. 1), who cites the reference to “things cognized through the senses” (τῶν δι’ αἰσθήσεως νοημένων) at *Harm.* 1.1, p. 3.13 Düring. Cf. the phrase “things in no way cognized through the senses” (τῶν μὴ δι’ αἰσθήσεως νοημένων) at *Crit.* 12, 18.5.

the intellect. And the relative weakness and unreliability of the senses in comparison to the intellect matches the view set out in the *Harmonics* (above, nn. 19–20). Ptolemy goes on in chapter 10 to explain the implications of this picture for understanding the proper uses of sense perception and intellect:

Thus we must neither dismiss sense perception as contributing little or nothing to the knowledge (ἐπίγνωσις) of the things that are (τῶν ὄντων), nor prefer its conclusion to that of thought (διάνοια), but rather distribute to each its proper work and make use of each for the things which it is naturally able to grasp infallibly (ἂ πέφυκε διαλαμβάνειν ἀδιαψεύστως). (ch. 10, 15.5–9)

As I noted in section 1 above, this passage anticipates Ptolemy's effort in the *Harmonics* to distinguish his own method from both an a priori rationalism (whereby sensory evidence would be "dismissed" in favor of rational theories) and from an uncritical reliance on the senses. Both the senses and the intellect are to be used for what they can grasp infallibly (ἀδιαψεύστως); Ptolemy goes on to explain what this amounts to in the case of the senses:

That is, we must make use of sense perception (αἴσθησις) for the presentation (δήλωσις) of the affections (πάθηματα) that it undergoes—for it tells the truth (ἀληθεύει) about these and states just what it has suffered, without qualification (φησιν αὐτὸ μόνον ἀπλῶς ὃ πέπονθεν); but that what has affected it is of such a kind (τὸ διαθὲν δ' ὅτι τοιοῦτον), it sometimes errs. And we must make use of the intellect (διάνοια) for the judgment (κρίσις) of both the affections (παθήματα) themselves and the things that give rise to them (τῶν διαθέντων). (ch. 10, 15.9–14)

I suggest that the doctrine that sense perception "tells the truth" (ἀληθεύει) about how it is affected should be understood in light of an idea with a long history in Greek epistemology: namely, the notion that the subjective experiences of the senses are veridical and cannot be questioned. For example, if the sense of sight conveys to the intellect the impression of a round tower, the statement "That looks like a round tower" cannot be questioned; for the statement is nothing more than an expression of the sense's report. Epicurus' doctrine that "all perceptions are true"—which Ptolemy here echoes—has also been interpreted along these lines.⁴⁹ This interpretation presupposes

⁴⁹ Striker 1977. For the irrefutability of the affections of the senses see Pl. *Tht.* 179c (acknowledging that there may be something to the claim that reports of "present affections" [τὸ παρὸν ἐκάστω πάθος] are instances of knowledge); Arist. *Metaph.* Γ 4, 1010b19–26 (even if the same wine may

that it is possible to express the content of sense impressions in linguistic form; but that is exactly what Ptolemy's picture of sense perception as a messenger leads us to expect (cf. the discussion of ch. 2 in section 2 above). Note that Ptolemy's view is not that the senses are *limited* to grasping their own πάθη. As in the lawcourt analogy—recalled here by the use of the term δήλωσις for the "presentation" of sensory evidence to the intellect—the senses are thought of as grasping external objects (αἰσθητά, ὑποκείμενα) and providing a rich representation of them; the point is that their reports, like the statements of advocates in court, are partisan and nonobjective. In other words, all that one can be certain about on the basis of the senses is the way things *appear* to be, not the way they are. This, Ptolemy suggests, provides a reliable basis for inferences about the nature of things in the world when it is combined with the intellect's power of critical judgment.

Next Ptolemy sketches a picture of the intellect's critical examination of the senses' reports:

For by joining to what is transmitted [by the senses] its memories of the properties (συμβεβήκοτα) of each thing, it exposes (ἀπελέγχει) in a progressive examination (ἀνάκρισις) both the things that have produced an appropriate affection (τὸ οἰκεῖον πάθος) in the senses, and those that have produced an inappropriate one. If the affection is inappropriate to what produces it, [it exposes] whether such a thing has come about by sense perception itself or by something external, sometimes making its examination through sense perceptions again—either those that are similar and unaffected (ἀπαθῆ), when the cause concerns the senses, or through dissimilar [perceptions] of the same object (ὑποκείμενον), when this is not the case. But many cases it submits, by itself, to reasoning (λόγος), and discovers what is appropriate to the nature of each thing (τὸ οἰκεῖον ἐκάστη φύσει) through a continuous movement divorced from the senses, in progressive contemplation. (ch. 10, 15.5–16.4)

The essential procedure is the comparison of sense impressions to those that have been stored in memory, presumably as ἐννοιαί. For example, repeated sense impressions lead to a conception (ἐννοια) that swans are white, so if sight reports the presence of a black swan, the intellect has reason to suspect that something has gone awry. In such a case,

taste sweet to some but not to others, there is no change in the sensation (πάθος) of sweetness, and the sense of taste always reports the truth (ἀληθεύει) about whether something *tastes* sweet; and Sextus, *Adv. math.* 7.191 (on the Cyrenaics): "that we feel whiteness or sweetness can be said infallibly (ἀδιαψεύστως) and incontrovertibly (ἀνεξέλεγκτως); but that the object productive of the affection (πάθος) is white or is sweet it is impossible to affirm."

the intellect's task is to determine whether the cause lies in the sense itself or in something external to it. If the cause lies in a particular sense (i.e. because the sense organs are in an abnormal state), the intellect compares perceptions of the same sense when in its normal state. For example, a jaundiced person will compare his (alleged) impressions that the world is yellow with the impressions he had when healthy.⁵⁰ If the senses are not themselves in an abnormal state, there must be some external cause of the error, such as a distortion in the air caused by an object's being viewed from a great distance. In such cases the intellect will try to circumvent the problem by considering "dissimilar [perceptions] of the same object," for example, perceptions of touch or hearing as well as vision. But in keeping with his general emphasis on the autonomy of the intellect, Ptolemy concludes by saying that in many cases the intellect will resort to reasoning (λόγος) and so discover "what is appropriate to the nature of each thing through a continuous movement divorced from the senses, in progressive contemplation."⁵¹

So far, then, Ptolemy has suggested that the basis of the senses' reliability lies in their reports of how they are affected by external objects. But he now goes on to identify a second source of reliability in the "simple" or "proper" judgments of the faculties of both sense and intellect:

One must, however, pay special attention to the simple and unmixed judgments (τοῖς ἀπλοῖς καὶ ἀμιγέσι κρίμασιν), whenever the transmissions of the impressions are unaffected and clear (ἐναργής), as being as unerring (ἀψευδής) as human power permits. For it is clear that some judgments (κρίματα) of the senses and the intellect (τῶν αἰσθησέων καὶ διανοιών) are proper (ἴδια), while others are common (κοινά). (ch. 10, 16.4–9)

The faculties in question include the five senses as well as the theoretical and practical intellect. As Ptolemy puts it, each of these faculties (δυναμέων) "naturally tells the truth (ἀληθεύειν πέφυκεν) whenever it considers (ἐπισκοπῇ) only what is peculiar and proper to it (τὸ ἴδιον καὶ οἰκεῖον μόνον), when it is undistracted (ἀπερσπαστος) by combinations

⁵⁰ My example; see Bullialdus (1663: 139–40) for examples involving the appearances of the planets and the moon.

⁵¹ For examples of the critical examination of the reports of the senses along these lines we can turn to book 2 of Ptolemy's *Optics* (extant only in a Latin translation [made from an Arabic version] edited by Lejeune 1989), which provides explanations of a wide variety of optical illusions in which the sense of sight fails to report the true nature of its objects. The distinction between errors arising from the sense of sight itself and those arising from external factors plays an important role in Ptolemy's account (cf. *Optics* 2.83, p. 55 Lejeune and 2.102, p. 64 Lejeune). These parallels are further evidence for the link between the epistemology of *On the criterion* and Ptolemy's scientific methodology.

[sc. with other faculties]" (ch. 11, 16.13–15). Ptolemy gives examples of simple judgments involving (a) the senses (when sight perceives color, or hearing sound), (b) the theoretical intellect (when it considers same or different, equal or unequal, and "in general the differences and similarities of forms [εἰδῶν]"), and (c) the practical intellect (when it considers "the appropriate and inappropriate (τὸ οἰκεῖον καὶ ἀνοῖκειον), and in general, the emotions (πάθη)" (ch. 11, 16.15–17.1). These contrast with the complex or common judgments that are made when different faculties combine with one another (συμπλακεῖσθαι) and share in (κοινωνήσασθαι) the judgment of external objects. Ptolemy suggests that such judgments arise in two kinds of case (ch. 11, 17.1–12). First, certain properties may be grasped by more than one faculty, as is the case with perceptible qualities such as bulk (ὄγκος), magnitude, number, shape, position, order, and motion, and intelligible qualities such as truth, choiceworthiness (αἰρετόν), and their opposites. Perceptible qualities such as magnitude, shape, and position can be grasped by more than one of the senses; similarly, judgments of what is true or choiceworthy may involve the cooperation of the senses and the intellectual faculties. A second class of complex judgments arises in the case of objects that are "multiform" (πολυειδής) by virtue of sharing in several "primary and unmixed properties," for example, the judgments that "this thing is a man or a horse" (in the case of perceptibles), or "man is the same as horse, qua animal, but different, qua rational" (in the case of intelligibles). Both "rational" and "animal" are predicated of "man"; therefore "man" cannot be grasped by a single act of either perception or intellect.⁵² In all such cases the faculties admit doubt and error.

Ptolemy's distinction between simple/proper and complex/common judgments is obviously based on the familiar Aristotelian distinction between proper and common sensibles.⁵³ In setting out this doctrine Aristotle makes the point that perception of the proper sensibles is always (or nearly always) accurate, while the perception of things that can be grasped by more than one sense (i.e. the common sensibles) is subject to error.⁵⁴ Aristotle's common sensibles—which include shape, size, and especially motion—correspond closely to Ptolemy's list of perceptible properties that involve complex judgments (ch. 11, 17.4–5).⁵⁵ Moreover it is exactly these kinds of properties

⁵² Cf. Bullialdus 1663: 149–50.

⁵³ E.g. *De anima* 418a7–25, 428b18–30, 430b29–31.

⁵⁴ E.g. at *De anima* 428b18–30 Aristotle says that perception of proper sensibles is always accurate "or shares as little as possible in error" (ἢ ὅτι ὀλίγιστον ἔχουσα τὸ ψεῦδος); by contrast, the senses can be wrong about the objects that produce the sensations, and are even less accurate where the common sensibles are concerned.

⁵⁵ For lists of the common sensibles in Aristotle see e.g. *De anima* 418a17–8 (κίνησις, ἡρεμία, ἀριθμός, σχῆμα, μέγεθος); 425a15–7 (adding the remark that the common sensibles are all grasped by motion, κίνησις).

that are said to be the special concern of the mathematical sciences in the *Almagest*.⁵⁶ This is significant for the evaluation of the place of observation in Ptolemy's scientific practice. For Ptolemy there is no question of the senses having an infallible grasp of quantitative properties such as shape and size; hence mathematical models that depend on grasping such properties are inevitably subject to error and uncertainty.⁵⁷

The idea that the intellect has a natural capacity to make certain simple judgments accurately also has a clear Aristotelian pedigree. In both *De anima* 3.6 (430a26–b31) and *Metaph.* Θ 10 (1051a34–1052a11) Aristotle argues that a certain class of intellectual judgments are free from error, and he draws an explicit analogy between the senses' grasp of their proper objects and the intellect's simple cognitions at *De anima* 430b26–31. These passages are somewhat obscure, but one contrast that does emerge reasonably clearly is between the intellect's grasp of "indivisible" (ἀδιαίρετόν) concepts or essences (where it either grasps a concept or does not, and there is no question of error) with cases where it predicates one thing of another (and so can be either correct or incorrect in doing so). Ptolemy's theory is *prima facie* different in that it is not concerned with the grasp of concepts or essences in general; rather, it attributes to the theoretical intellect the ability to judge particular basic concepts such as similarity, difference, equality, and the like. Still, the idea that there is a class of simple or intuitive judgments of the intellect that are free of error is common to both Ptolemy and Aristotle, and a further indication of the Aristotelian background to Ptolemy's theory.

Ptolemy offers no justification for his theory of the natural reliability of the simple or proper judgments of the senses and the intellect. But the important role played by the notion of faculties (δυνάμεις) in his account, combined with the appeal to the idea of the senses' *natural* reliability (ἀληθεύειν πέφυκεν, 16.15) and the teleological considerations invoked in the comparison of intellect and sensation in chapter 9, suggests a teleological justification. The argument would be that whatever can be grasped by one faculty *alone* must be the particular activity or actualization of that faculty.⁵⁸ On the assumption that faculties are correlated with specific activities *by nature*, there would then be a reason to conclude that the ability to grasp the proper objects of sense and intellect is also present in human beings by nature.

If the foregoing analysis is correct then Ptolemy's epistemology rests on two foundations: the veridical character of subjective experience, and the natural capacity of

the intellectual and sensory faculties to judge correctly about the matters that are distinctive to them. The distinction between the two ideas is clearest in the case of sense perception. When Ptolemy says that the senses report their παθήματα truly, there is no reason to suppose that these παθήματα are *restricted* to reports of proper qualities (so that sight, for example, would report only on an object's color). The lawcourt analogy suggests that the senses offer rich representations of objects via φαντασία. Furthermore, what makes the Aristotelian common sensibles "common" is of course just the fact that they can be grasped by more than one sense; hence Ptolemy in the *Optics* quite correctly describes sight as grasping both proper and common sensibles, for example, both color and shape.⁵⁹ The doctrine that the senses naturally tell the truth about their proper objects is a separate idea, based on teleological considerations, that establishes a clear connection between mind and world: color actually exists in the world, independently of the human mind, and the sense of sight is naturally suited to grasp it. In the case of the practical intellect, the distinction between the veridicality of subjective experience and the natural reliability of the faculties' proper judgments is blurred insofar as Ptolemy gives πάθη (i.e. emotions) as examples of judgments proper to the practical intellect. This suggests the veridical character of subjective experience: one either feels angry or one does not, and there is no arbiter in the matter other than the reaction of the practical intellect. But the practical intellect also has as its distinctive objects the "appropriate and inappropriate" (οικεῖον καὶ ἀνοικεῖον), and such judgments are not necessarily a matter of subjective feeling. As far as the theoretical intellect is concerned, Ptolemy surely cannot mean to say that just because we *think* we grasp the differences between forms, therefore we *do*, in the same way that because we *feel* angry, we *are* angry. Something more is needed to ensure that the mind is grasping real differences in the world; this connection is secured by appeal to the Aristotelian idea that the human intellect possesses faculties that can reliably make the kinds of judgments that are distinctive to them.

The remainder of Ptolemy's epistemological account (ch. 12) is concerned with clarifying the contributions of λόγος. First Ptolemy summarizes what αἴσθησις and νοῦς are able to do *independently* of λόγος:

Now the absolute and primary criteria (τὰ ἀπολελυμένα καὶ πρῶτα κριτήρια)⁶⁰ are immediately capable of grasping (καταληπτικά) apart from reasoning (χωρὶς λόγου), and need no other principle (ἀρχή) at least insofar as their activity itself

⁵⁶ I 6.1–4 H; above, n. 18.

⁵⁷ The theory of proper sensibles figures in both the *Harmonics* (3.3, p. 93.14–20 Düring) and the *Optics* (e.g. 2.13, p. 17 Lejeune). In the latter work Ptolemy explains several errors in visual perception as being due to the difficulty that sight has in grasping objects other than color (2.134–6, pp. 80–82 Lejeune).

⁵⁸ Cf. ch. 9, 14.20–21: rational thought is the "proper faculty" (τὴν οἰκείαν δύναμιν) of "more perfect" (τελειότερα) creatures.

⁵⁹ *Optics* 2.2, p. 12 Lejeune: *Dicimus ergo quod visus cognoscit corpus, magnitudinem, colorem, figuram, situm, motum, et quietem.*

⁶⁰ I.e. the intellect (νοῦς) and sense perception (αἴσθησις).

is concerned (κατά γε τὴν ἐνέργειαν αὐτήν).⁶¹ They grasp (ἀντιλαμβάνεται), first of all, themselves and their special movements, according to the inner consciousness (συναίσθησις); then, the primary sense organs, and those external objects which are stable and share in forms; and, by virtue of the memory which is extended from perceptible things, the forms themselves as things separated and divorced from the existence of particulars (ὡς κεχωρισμένων τινῶν καὶ ἀπηλλαγμένων τῆς τῶν καθ' ἕκαστον ὑποστάσεως). (ch. 12, 17.17–18.4)

From this passage it emerges that sense perception and intellect can do quite a bit without λόγος. Not only are they aware of their own activity; they also have the ability to grasp objects in the world (the things that “share in forms”), and the forms themselves as separate from their instantiations in sensible particulars.⁶² Thus, λόγος is not required for a preliminary grasp of forms; for this, memory (and the associated ἔννοιαι) are sufficient.⁶³ That it is only a *preliminary* grasp is suggested by the fact that Ptolemy goes on immediately to remark that without using λόγος the intellect can easily go wrong by conceiving “images” (εἰδῶλα) and “apparitions” (φαντάσματα) of things that are “not at all cognized through the senses” (τῶν μὴ δ' αἰσθήσεων νενοημένων), for example, evil spirits or giants (ch. 12, 18.4–9). The implication is that λόγος is needed to avoid such error and secure true beliefs, as well as a reliable grasp of forms.

Furthermore, a certain kind of λόγος is also needed in order to move from true belief to knowledge:

When the internal reasoning (ἐνδιάθετος λόγος) of thought is joined with these simple and non-inferential (ἀσυλλογίστοις) criteria in independent application (κατὰ τὴν ἀπολελυμένην ἐπιβολήν), it too still only forms opinions (δοξάζει); but when in clear (ἐναργής), skillful (τεχνική) discernment, it takes on the condition of knowledge, by separating and combining the differences and absences of difference between existing things (τῶν ὄντων), and moving up from particulars to universals and all the way up to the genera and species (εἶδη) of objects (ὑποκείμενα). (ch. 12, 18.9–17)

⁶¹ Lammert emends the MSS' reading ἐνέργειαν (“activity”) to ἐνάργειαν (“clarity”), but I do not think this is necessary given Ptolemy's emphasis on the Aristotelian distinction between δύναμις and ἐνέργεια elsewhere in the text (e.g. ch. 9, 14.4–9).

⁶² The qualification “as separated” (ὡς κεχωρισμένων) is of course crucial: these are Aristotelian forms that are separable from particulars only in thought.

⁶³ For Alcinous' similar view see above, n. 38.

Ptolemy picks up his earlier remark that the “simple and undifferentiated” application of internal λόγος becomes opinion, while its “skilled and unshakeable” application becomes ἐπιστήμη and γνώσις (ch. 2, 6.9–11). As the term τεχνική suggests, the contrast between the two applications of λόγος lies in the systematic character of the latter: ἐπιστήμη results from the application of reasoning that is integrated into a larger system and therefore “unshakable” (ἀμετάπειστος). This is of course a notion that can be traced back to Plato and Aristotle; notably, however, Ptolemy shows no hint of the Platonist idea that belief is distinguished from knowledge by its different objects.⁶⁴ The chapter concludes with an example illustrating the progression from sense perception to knowledge:

As whenever from encountering Plato and Dion and the similarity of particular form (τῆς καθ' ἕκαστον τοῦ εἶδους ὁμοιότητος) it thinks of a common genus, man, and from encountering man and horse it thinks of animal, and from encountering animal and plant, what is (τὸ ὄν) itself, and in this way it passes back downwards distinguishing and dividing always what is divided in species as indivisible in genus until, passing to things that are entirely indivisible and have no common genus, it finds that the individual particulars (τὰ καθ' ἕκαστον) are consistent (σύμφωνα) with the principles that have been derived [from them], making a circuit and revolution that is unchangeable and incontrovertible. (ch. 12, 18.17–19.6)

The methodology of ascending from particulars to universals is exactly that which Ptolemy follows in his investigation of the κριτήριον. What is new here is the idea that one must also descend from the universal to the particular to ensure that the initial observations are in agreement (σύμφωνα) with the theories derived from them. This recalls the importance of συμφωνία in Ptolemy's scientific methodology as noted in section 1 above. What Ptolemy is presenting here is an analog not of mathematical demonstration but of the process of building mathematical models and assessing their predictions in light of observations. The reliability of one's grasp of universals and the distinctions between them—the “theory” that is being described in this passage—is dependent on the ability to show that it matches the initial observations. The idea of a “circuit” (περίοδος) and “revolution” (ἀνακύκλησις) is an appropriate analog for the iterative process of developing a mathematical model from initial observations and assessing it against further observations until agreement (συμφωνία) has been achieved.

⁶⁴ Alcinous, *Didask.* 4, p. 154.29–32 Hermann: “scientific reason” (ἐπιστημονικὸς λόγος) is reliable and stable (βέβαιος, μόνιμος) because it is concerned with principles that are themselves reliable and stable.

It is this *circuit* that Ptolemy calls “unshakeable and incontrovertible,” and its reliability depends ultimately on agreement with observation.

4.

I have argued that *On the criterion* sets out an epistemological theory that answers to the distinctive problems and emphases of Ptolemy’s work in the exact sciences. The theory explains how the human intellect can grasp the kinds of formal properties that are studied by mathematics as Ptolemy conceives of it. It clarifies the roles of sense perception and intellect and suggests guidelines for how the two should be used to develop scientific theories. The overall emphasis in both the lawcourt analogy and the subsequent discussion is on the relative limitations of sense perception in comparison to the intellect and the need for the intellect to judge the evidence of the senses via λόγος. The infallibility of the senses in reporting how they are affected, and their natural ability to grasp their proper objects, is sufficient to secure an empirical basis for the mathematical sciences. The intellectual faculties, like the senses, are naturally able to grasp the truth concerning matters that are distinctive to them. But judgments about quantitative properties relevant to the mathematical sciences, and of properties such as truth, involve different faculties working together and so are susceptible to error. By using reasoning or λόγος the mind can avoid error and move from true belief to knowledge; but scientific knowledge in fields such as astronomy and harmonics depends on agreement with observation and so is fallible.

In framing this epistemological theory for his scientific work, Ptolemy draws on a wide range of philosophical theories. His appeal to the infallibility of the senses’ reports of their affections (πάθη, παθήματα) echoes Epicurus’ famous dictum that “all perceptions are true,” while the doctrine of the reliability of the senses and intellectual faculties when judging their proper objects is Aristotelian in inspiration. On the whole the theory’s closest affinities are with the Peripatetic tradition. But Ptolemy’s epistemology has a number of distinctive features within this tradition, including (1) the idea that the senses’ reports of their παθήματα are a reliable source of empirical evidence; (2) the attempt to ground the natural reliability of the faculties of both sense and intellect on the doctrine of simple or proper judgments; and (3) the comparatively minor role played by the notion of “clarity” or “vividness” (ἐνάργεια) in his account.⁶⁵

⁶⁵ ἐναργής occurs only twice in the text. At ch. 10, 16.5–6, ἐναργῆ is paired with ἀπαθείς (“unaffected”), referring to the senses’ transmissions (διαδόσεις) of impressions of their proper objects; at ch. 12, 18.18.12–3 it is paired with τεχνική and refers to the discrimination (διάκρισις) that is carried out via λόγος. A third instance in Lammert’s text is ἐνάργειαν at ch. 12, 17.19, but this rests on an unnecessary emendation of the MS reading ἐνέργειαν (above, n. 61). By contrast, the notion

As I have noted, Ptolemy’s appeal to the Aristotelian doctrine of proper judgments could provide him with a neat teleological argument for his theory: each faculty is naturally constructed to grasp what is distinctive to it. Moreover, Ptolemy viewed his mathematical theories as providing powerful evidence for the teleological order and underlying rationality of nature; as he puts it in the *Harmonics*, “in everything it is the proper task of the theoretical scientist to show that the works of nature are crafted (δημιουργούμενα) with reason and with an orderly cause.”⁶⁶ Thus the success of his mathematical theories themselves could provide a reason to adopt an epistemological theory based on the idea that human beings have the natural ability to make reliable judgments about the world.

I conclude with some very brief reflections on the implications of *On the criterion* for the understanding of Ptolemy’s scientific method. The consistent emphasis on the role of intellect as the authoritative judge (via λόγος) of sense impressions in *On the criterion* suggests that Ptolemy was profoundly aware of the importance of theoretical considerations in driving the selection and evaluation of empirical data. This may help to shed light on his practice in cases where he has been accused of being rather cavalier—if not dishonest—in his handling of such data. Two notorious examples are the star catalog in books 7–8 of the *Almagest*—where Ptolemy’s claim to have carried out detailed observations has been called into question in light of similarities between his results and the earlier work of Hipparchus—and the analysis of refraction in book 5 of the *Optics*, where what is presented as observational data seems to have been derived from a theoretical model. In both cases, close study of the methodological assumptions that govern Ptolemy’s practice reveals that they conform quite well to the emphasis on the priority of intellect and λόγος in *On the criterion*.⁶⁷ In this way the study of Ptolemy’s foray into epistemology may help us gain a better perspective on his methods in those works on which his intellectual reputation chiefly, and rightly, rests.

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of ἐνάργεια figures prominently in both Sextus’ report on the Peripatetics (*Adv. math.* 7.217–8) and in Galen’s Peripatetic-inspired epistemological discussions (e.g. *De opt. doct.* 1.49 Kühn; *De plac. Hipp. et Plat.* 9.7.3–5, 5.778–9 Kühn); cf. Tarrant 1981.

⁶⁶ *Harm.* 1.2, p. 5.19–21 Düring; transl. Barker 1989.

⁶⁷ On the basis of a close study of the star catalog Grasshoff (1990: 209–16) characterizes Ptolemy’s methodological perspective as one of “holistic rationalism,” in which observations are subject to radical evaluation and revision in light of theoretical considerations. Similarly, Smith (1982) explains Ptolemy’s handling of refraction as an understandable attempt to apply a theoretical framework to guide empirical investigation in a particularly difficult case.

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