

Philosophical Presentation in Ptolemy's *Harmonics*: The *Timaeus* as a Model for Organization

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THANKS TO his astronomical observations recorded in the *Almagest* and the text of his *Canobic Inscription*,¹ we can place Ptolemy's activity in the middle of the second century at Alexandria.² His work is mainly valued in the history of science for its contribution to planetary theory, but that same scientific interest that Ptolemy awakens has in part obscured other, not strictly mathematical features of his works.³ In fact, it is only recently that scholars have begun to study systematically the technical writings of the Greco-Roman period as cultural artefacts in relation to their contemporary intellectual context, beyond how their contents contribute to the history of their particular disciplines.

The main feature generally shared by the texts of this period is their compilatory character: originality of content is now not

¹ The observations were made between 127 and 141 A.D. in Alexandria: O. Pedersen, *A Survey of the Almagest*² (New York 2010) 416, 422. The inscription was erected in 146/7 in Canopus, a suburb of this city: A. Jones, "Ptolemy's *Canobic Inscription* and Heliodorus' Observation Reports," *SCIAMVS* 6 (2005) 53–98, at 53.

² As to the relative chronology of the treatises, it has been shown that the *Canobic Inscription* predated the *Almagest*: N. T. Hamilton, N. M. Swerdlow, and G. J. Toomer, "The *Canobic Inscription*: Ptolemy's Earliest Work," in J. L. Berggren et al. (eds.), *From Ancient Omens to Statistical Mechanics* (Copenhagen 1987) 55–75. The *Almagest* itself is mentioned in the *Tetrabiblos*, *Planetary Hypotheses*, *Planispherium*, *Handy Tables*, *Geography*.

³ The skillful arrangement of such a technically difficult work as the *Almagest* has been nevertheless long noted: Pedersen, *A Survey of the Almagest* 25.

as important as proper (and original) arrangement. This was the result of a number of factors, mainly the sense of accumulated knowledge passed down through tradition, and the increasing educational demands of the leisured classes. In relation to this, authors resorted to a series of conventions which, in one way or another, served to generate interest and defend their own projects. Ptolemy was no exception. He wrote treatises on a variety of subjects, mostly related to astronomy and spherical geometry but also comprising optics, harmonics, and epistemology. The term he most frequently used to refer to his best-known works, σύνταξις—system, arrangement, organization, composition—is an apt description of their compilatory character.⁴ These three works—the *Almagest*, the *Tetrabiblos*, and the *Geography*—along with the *Harmonics* and the *Optics* certainly are, among Ptolemy's treatises, the ones which most conform to our sense of an exhaustive treatment.⁵ In this paper I will show how Ptolemy conformed to presentational strategies attested for other writers of the period, in a more or less conventional manner, in the preface of the *Almagest*, and in a quite unusual way in the *Harmonics*, in particular regarding what I will call 'philosophical presentation'.⁶

⁴ The title of the *Almagest* is Μαθηματικὴ σύνταξις, but it is also called ὑπομνηματισμός (memorandum) at *Alm.* I.2 p.608.8 (ed. Heiberg). Ptolemy also refers to the *Tetrabiblos* as σύνταξις in *Tetr.* 1.1.1, 3.2.5, 3.7.2, and 3.12.8; in 1.3.19 he speaks of "iatromathematical treatises" (ιατρομαθηματικῶν συντάξεων) using this term as well. The *Geography* is titled Γεωγραφικὴ ὑφήγησις (guide, description), but is referred to as σύνταξις at *Geogr.* 7.4.14 and 8.1.6; in other places Ptolemy also designates Marinus' geographical treatises with this term: 1.6.2, 1.15.1, 1.17.1, 1.18.3, and 1.19.1. The term is frequently used by authors referring to their own compilatory treatises in Ptolemy's time and before: Vett. Val. 108.18, Hero *Def.* proem. 1.4, Phil. Byz. *Belop.* 52.47, Hypsicl. *Elem.* proem.

⁵ The rest are either related to the planetary models worked out in the *Almagest*—*Planetary Hypotheses*, *Handy Tables*, *Canobic Inscription*—or deal with rather specific topics in spherical geometry—*Phases of the Fixed Stars*, *Analemma*, *Planisphere*—and philosophy—*On the Criterion and Commanding Faculty*.

⁶ Ptolemy, unlike e.g. Galen, has not yet been studied from this perspective, although recent work has been carried out on the philosophical content

Prefatory conventions in the Almagest

As can be expected, these conventions are generally observed in the prefaces, and indeed the preface of the *Almagest* could be used as a sort of compendium of self-presentational motifs. First of all, the reader notices that the work is addressed to a certain Syrus, whom Ptolemy apostrophizes with a simple vocative, not giving any further detail.⁷

his work: see J. Feke, “Ptolemy’s Defense of Theoretical Philosophy,” *Apeiron* 45 (2012) 61–90; L. C. Taub, *Ptolemy’s Universe: The Natural Philosophical and Ethical Foundations of Ptolemy’s Astronomy* (Chicago 1993). For Galen see the essays in C. Gill et al. (eds.), *Galen and the World of Knowledge* (Cambridge 2009); and S. P. Mattern, *Galen and the Rhetoric of Healing* (Baltimore 2008). For a mathematician close to Ptolemy’s time see S. Cuomo, *Pappus and the Mathematics of Late Antiquity* (Cambridge 2000); see also the essays about technical writers in L. C. Taub and A. Doody (eds.), *Authorial Voices in Greco-Roman Technical Writing* (Trier 2007), and J. König and T. Whitmarsh (eds.), *Ordering Knowledge in the Roman Empire* (Cambridge 2007).

⁷ Probably for this reason, an anonymous commentator on the *Tetrabiblos* (*Εἰς τὴν τετράβιβλον τοῦ Πτολεμαίου Ἐξηγητῆς ἀνώνυμος* [Basel 1559] 1; now R. Caballero-Sánchez, *MHNH* 13 [2013] 225) implausibly considered Syrus an invented dedicatee (πέπλασται), and also mentions a tradition that Syrus was “a physician trained in this sort of mathematics” (ἰατρὸς ἦν οὗτος ἀχθεὶς καὶ διὰ τούτων τῶν μαθημάτων), probably only inspired by Ptolemy’s comparison between medicine and astrology at the beginning of the treatise (see n.4 above). Despite the use as slave name in comedy and Lucian—Eriphus fr.6 (Ath. 137D), Anaxandrides fr.19 (Ath. 176A); Luc. *Tox.* 80, *Bis acc.* 23—Σύρος, literally ‘Syrian’, was a quite common name in the Hellenistic and Roman east, especially in Asia Minor and Egypt. A total of 657 individuals with this name are recorded in Egypt; cf. the 6549 named Πτολεμαῖος or the only 28 named Πάππος. The few double names including Σύρος (twelve in papyri, four in inscriptions) might give us an idea of the reasons for its popularity: an individual named Σύρος in Lycia was also called Συριάρχης (*TAM* II 1225), which connects the name with notions of political domination of Syria, a quite pertinent issue in Hellenistic Egypt. Another possible connotation may come from the phonetic similarity with the name of the Egyptian god Osiris, who gave rise to a number of popular names such as Πετοσίρις. It may be significant that an Egyptian named Σύρος also bears the name Ψενοσείρις (*I.Akoris* 4); furthermore, Σύρα is almost always coupled with Ἰσάρτιον, derived from Isis, when it appears as a double name (8 out of 11 cases). Papyri have been searched in papyri.info; inscriptions in *PHI*; attestations of individuals in Egypt in Trismegistos (last

As J. König remarks in his study of prefatory conventions in Galen, compilatory writers frequently seek external arguments for writing, feeling—consciously or not—that a not-wholly original work would be difficult to justify *per se*. Suggesting that they were writing on request was a typical solution to this.⁸ Here, as often in Galen,⁹ no details are given about the addressee, implying that the author does not care about the prestige of his friends. Syrus is actually addressed in the same way in most of the other astronomical works, including the *Tetrabiblos*. Ptolemy is only a little more specific in the preface of the *Analemma*, expressing his wish that the work will help Syrus in understanding the theory (*si quid tibi videmur ad intellectum coauxisse*, II 189.14). This work deals with a special technique of spherical geometry used for measuring the course of the sun, and it supposes previous reading in the field not supplied by Ptolemy,¹⁰ so it seems plausible that its dedicatee had expressly asked for it. Choosing a friend who was genuinely interested rather than a powerful potential patron had the advantage of displaying a credible didactic situation with which the reader could identify, even if the addressee did not seem to be a pupil in the normal sense of the word.¹¹

consulted 3/6/2015).

⁸ J. König, “Conventions of Prefatory Self-Presentation in Galen’s *On the Order of My Own Books*,” in C. Gill et al. (eds.), *Galen and the World of Knowledge* (Cambridge 2009) 35–58, at 43–44.

⁹ König, in *Galen and the World of Knowledge* 51.

¹⁰ N. Sidoli, *Ptolemy’s Mathematical Approach: Applied Mathematics in the Second Century* (diss. Univ. Toronto 2004) 184.

¹¹ The majority of Galen’s dedicatees are of this type, a partial exception being Flavius Boethus, who in addition to being interested in medicine was of consular rank: see W. A. Johnson, *Readers and Reading Culture in the High Roman Empire: A Study of Elite Communities* (Oxford 2010) 78; contrast the paternal way in which the astrologer Paul of Alexandria addresses his unknown dedicatee, ὦ φίλε παῖ Κρονάμων (*Elem.* 1), likewise Theon in his commentaries on Ptolemy: τέκνον Ἐπιφάνιε (*Comm.Alm.* p.317 Rome, *Comm. parv.* p.199 Tihon), μοὶ ἑταῖροι Εὐλόλιε τε καὶ Ὠρίγενης (*Comm.magn.* p.93 Mogenet/Tihon).

Ptolemy depicts himself as dedicated to the teaching of mathematics in his spare time (τῆ σχολῇ, I.1 5.4).¹² This is related to another of the common presentational devices of technical authors, reluctance to write and the pose of being occupied,¹³ which gave the impression of being a scholar in demand. Often the motivation for overcoming such a difficulty was expressed as an overarching ethical aim: Ptolemy is no exception in this either, for towards the end of the preface he mentions that by writing he aims “to constantly increase this love of contemplation of the eternal and the unchanging” (τοῦτον δὲ καὶ αὐτοὶ τὸν ἔρωτα τῆς τῶν αἰεὶ καὶ ὡσαύτως ἐχόντων θεωρίας κατὰ τὸ συνεχὲς αὖξεν πειρώμεθα, 7.25–27), referring to the ethical virtues instilled by the study of astronomy, which he has outlined in the previous lines.

The other obvious ways in which Ptolemy presents his *Almagest* relate to philosophy. We can distinguish at least three different strategies: first, in order to situate his field of study within a broader framework of knowledge, Ptolemy defines astronomy through a series of divisions beginning with the initial distinction between theoretical and practical philosophy.¹⁴ Another typical device, here linked with the first, consists

¹² Ptolemy contrasts his teaching in spare time with a good disposition “in ordinary affairs” (ἐν τοῖς τυχοῦσιν). A. Bernard, “The Significance of Ptolemy’s *Almagest* for its Early Readers,” *Revue de Synthèse* 131 (2010) 495–521, at 512–518, emphasizes the importance of ethical disposition in ancient astrology in connection with Ptolemy’s general project; given Ptolemy’s expertise in astrological theory as shown in the *Tetrabiblos*, and his interest in providing planetary tables useful for direct use in astrological practice (the *Handy Tables*), it does not seem far-fetched to speculate that Ptolemy could have been a professional astrologer.

¹³ König, in *Galen and the World of Knowledge* 46, analyzing Nicomachus’ preface to his *Manual of Harmonics*; 48–49 for Quintilian; 51–58 for Galen.

¹⁴ Ptolemy, citing Aristotle, distinguishes three types of theoretical philosophy—physics, mathematics, and theology (I.1 5.8–9)—after declaring that he is dedicated to mathematics, and later on he specifies that he will deal with astronomy in particular (ἐξαιρέτως δὲ τῆς περὶ τὰ θεῖα καὶ οὐράνια κατανοουμένης, I.1 6.23–24). König, in *Galen and the World of Knowledge* 41, calls this kind of procedure “quasi-Socratic division.”

in presenting the author's own project as philosophical or totalizing. In particular, the most striking passage of Ptolemy's preface is the one in which he defends the thesis that, among the Aristotelian parts of theoretical philosophy, only mathematics can really be called scientific knowledge, the other two being rather conjecture (τὰ μὲν ἄλλα δύο γένη τοῦ θεωρητικοῦ μᾶλλον ἢ τις εἰκασίαν ἢ κατάληψιν ἐπιστημονικὴν εἴποι, I.1 6.11–13). Mathematics is then argued to be the central part of theoretical knowledge, and the only way to approach both theology and physics (6.25–7.16). Adding to this the aforementioned contribution to ethics, mathematics will reach every branch of philosophy.

The third strategy that Ptolemy displays in the preface of the *Almagest* is the imitation of philosophical discourse: he does not just say that he is engaging in philosophy, but also writes as though he were writing a philosophical treatise. If it were not for the title of the work, we would not know that it is on mathematics until the nineteenth line of text (in Heiberg's edition), and not until the sixtieth would we learn that it is actually about astronomy; in addition, in both places this focus is expressed quite ambiguously, suggesting that mathematics is really nothing but a part (albeit the most important) of philosophy.¹⁵

Philosophical presentation at the end of the Harmonics

The preface of the *Almagest* is the best passage to illustrate the variety of presentational strategies at play in Ptolemy's work. The prefaces of the *Tetrabiblos* and the *Geography* are also interesting in regard to rhetoric, but they are more specific than that of the *Almagest*, and without references to philosophy. They defend a strong mathematical approach in either case: by contrast with astronomy, astrology and geography are not con-

¹⁵ Adducing the many points of this preface shared with the Plato handbook of Alcinous, Feke, *Apeiron* 45 (2012) 82, argues that "Ptolemy appropriated the structure of *Almagest* 1.1 from contemporary philosophical handbooks."

sidered mathematical themselves, but physical. Ptolemy's general argument is here in line with that of the *Almagest* preface, in which mathematics is portrayed as the best way to approach physics.¹⁶ Apart from relating these fields to mathematics, Ptolemy concentrates in both cases on the subject's own problems, defending the very possibility of astrology in the case of the *Tetrabiblos*,¹⁷ and separating geographical inquiry from chorography—dealing with limited extensions of territory—in the *Geography*.

Philosophical presentation, however, also occurs in the *Harmonics*, where it is not concentrated in the preface. In what follows, I will compare Ptolemy's philosophical presentation in the *Almagest* with that of the *Harmonics*, arguing that in the latter treatise the procedure is applied in a highly unconventional way, which deserves closer analysis.

In the *Harmonics*, it is striking that many typical instances of self-presentation are placed in the final part of the treatise, approximately the last fifth of the text, which begins at 3.3. This chapter opens with the observation that the project set out at the beginning of the work (1.2), consisting of the demonstration of the ratios of attunement (τὸ ἡρμωσμένον), has been concluded.¹⁸ In the next sentence, Ptolemy announces a new objective of his inquiry (3.3 [92.1–8 Düring]):

¹⁶ A “more mathematical” approach to physics, along with a “more physical” approach to mathematics, is also defended in the preface to the *Analemma*: II 189.6–7: *naturali theorie opus est aliqua coassumptione magis mathematica et mathematice magis naturali*. Cf. a similar claim in Theon Smyrn. *Math.* p.177.21 Hiller: δέον ἅμα καὶ φυσικῶς περὶ τούτων ἐπισκοπεῖν, criticizing the allegedly imperfect astronomical methods of the Greeks that derived from the Babylonians and Egyptians; Theon appeals here to Aristotle and to the Platonic *Epinomis* in order to sustain his claim.

¹⁷ See the excellent analysis of A. A. Long, “Astrology: Arguments Pro and Contra,” in J. Barnes (ed.), *Science and Speculation: Studies in Hellenistic Theory and Practice* (Cambridge 1982) 165–192.

¹⁸ A. Barker, *Greek Musical Writings II Harmonic and Acoustic Theory* (Cambridge 1989) 371 n.26.

ἐπεὶ δ' ἀκόλουθον ἂν εἶη τῷ θεωρήσαντι ταῦτα τὸ τεθαυμα-
κέναι μὲν εὐθύς, εἰ καὶ τι ἕτερον τῶν καλλίστων, τὴν ἁρμονικὴν
δύναμιν ὡς λογικωτάτην καὶ μετὰ πάσης ἀκριβείας εὐρίσκου-
σάν τε καὶ ποιούσαν τὰς τῶν οἰκείων εἰδῶν διαφορὰς, ποθεῖν δ'
ὑπὸ τινος ἔρωτος θείου καὶ τὸ γένος αὐτῆς ὡςπερ θεάσασθαι,
καὶ τίσιν ἄλλοις συνήπται τῶν ἐν τῷδε τῷ κόσμῳ κατα-
λαμβανομένων, πειρασόμεθα κεφαλαιωδῶς, ὡς ἔνι μάλιστα,
προσεπισκέψασθαι τοῦτο δὴ τὸ λείπον τῇ προκειμένῃ θεωρίᾳ
μέρος εἰς παράστασιν τοῦ τῆς τοιαύτης δυνάμεως μεγέθους.

Since it would follow for the person who has contemplated these things to wonder immediately—if he also wonders at any other of the most beautiful things—at harmonic power, which most rationally and with complete accuracy finds and creates the differences between the proper forms; and to desire, under the influence of some divine love, to observe, as it were, its own kind, as well as which other things it is linked with among those included in this world, we will try, in a summary way, as far as it is possible, to append this review in the remaining part of the study at hand, in order to display the greatness of this kind of power.

In other words, the new project does not concern how harmony works, which has already been shown, but is about harmony (or “harmonic power”) itself in relation to other things: we are, in a sense, zooming out. It is interesting that the motivation that Ptolemy suggests for this kind of inquiry, the divine love to contemplate, is the same that we have seen at the end of the preface of the *Almagest* as the overarching ethical aim of astronomy. Differently from in the *Almagest*, then, in the *Harmonics* Ptolemy seems to view the ethical virtues of the field as only emanating from the last part of his study.

It is in this context, as well, that mathematics is defined (“the science that embraces all the species close to reason,” τὴν κοινὴν τῶν παρὰ τὸν λόγον εἰδῶν ἐπιστήμην, ἰδίως δὲ καλουμένην μαθηματικὴν (3.3 [93.6–7]), not however as part of an explanatory division as in the *Almagest*, but as the conclusion from an argument about three different kinds of cause related

with reason (92.17), which serves to emphasize the practical and demonstrational aspect of the science.¹⁹ In turn, reason, with which mathematics is identified, “falls between the other causes mentioned and collaborates with them in producing the good” (μεταξὺ τῶν εἰρημένων αἰτίων πίπτων ἑκατέρῳ συναπεργάζεται τὸ εὖ, 92.21–22), a move which recalls the procedure in the preface of the *Almagest* of emphasizing the centrality and indispensability of mathematics in relation to the other two divisions of theoretical philosophy.

Similarly as well to what we see in the *Almagest* is the fact that Ptolemy thereafter introduces the proper field of study within mathematics, this time harmonics. Interestingly, he here pairs it with astronomy as the most rational of the sciences (3.3 [94.13–20]), relating them to the senses of hearing and sight respectively, the senses that are closest to the commanding faculty (93.11). The claim that harmonics and astronomy are cousins born of the sisters sight and hearing and brought up by arithmetic and geometry is immediately recognizable as an elaboration of a Pythagorean metaphor alluded to by Socrates in *Republic* 7, where music is presented as one of the sciences that the future guardians of the ideal polis should learn.²⁰

Finally, at the end of the fifth chapter (3.5 [97.27–98.4]) Ptolemy presents the philosopher, making reference to the passage of the *Republic* in which the soul of the man who attains justice is said to be harmonized like three notes (443D).²¹ Justice is pre-

¹⁹ Cf. *Alm.* I.2 608.7–8: πρὸς τὸ εὐχρηστον μόνον τῆς θεωρίας, ἀλλ’ οὐ πρὸς ἔνδειξιν. Not surprisingly, mechanical writers frequently resorted to this topic: cf. the preface of Athenaeus *Mech.* (4), directed against the authors who according to him failed to write in a useful manner; also Vitruvius’ defence (1.1–2) of the combination of practice and theory.

²⁰ Pl. *Resp.* 530D8: ἀδελφαί τινες αἱ ἐπιστήμαι εἶναι. Plato’s likely source is Archytas fr.1 D.-K., where geometry, arithmetic, astronomy, and music are said to be sister sciences; these are roughly the same sciences that Socrates prescribes in his programme, and the same that Ptolemy mentions. Cf. Barker, *Greek Musical Writings* II 373 n.34; C. Huffman, *Archytas of Tarentum: Pythagorean, Philosopher, and Mathematician King* (Cambridge 2005) 109.

²¹ Cf. Plut. *Plat. quaest.* 1007E commenting on *Resp.* 443D, and trying to

sented by Ptolemy as a concord between the parts of the soul, and therefore as a concord of concords (since the parts of the soul themselves have been associated with concords); the condition of the philosopher is then said to consist of the harmony of the complete musical system. Just thereafter, Ptolemy divides the theoretical (which he calls here “principle,” ἀρχή, 3.6 [98.6]) into natural, mathematical, and theological, exactly as in the preface of the *Almagest*, likewise arguing that mathematics holds the central position because it “is involved to a high degree both in the natural and in the theological” (ἐπὶ πλεῖστον ἀναστρέφεται καὶ τῷ φυσικῷ καὶ τῷ θεολογικῷ, 98.22).

It is by now clear that Ptolemy, in the *Harmonics*, uses similar elements of philosophical presentation as in the preface of the *Almagest*. But by placing these elements at the end of the work and as a result of arguments involving the status of harmony, he makes them not preliminaries to a mathematical investigation, but in a way its result or application. In fact, the philosopher and the parts of philosophy only appear as objects to which harmonic ratios, investigated earlier in the mathematical part of the work, can be applied. Bearing in mind Ptolemy’s references to the *Republic* and specifically to the Socratic programme of investigating astronomy in combination with harmonics, the impression is that Ptolemy wants the reader to notice that he is following Socrates’ advice of using mathematics as a tool for engaging in philosophy (*Resp.* 531D). This would certainly fit with his claim that mathematics contributes to philosophy in general because of its very centrality. Ptolemy was therefore appropriating Plato’s arguments in order to defend his own project, even if Plato would never agree in seeing mathematics as the most important part of philosophy.

But there is more to it: I will claim that Ptolemy imitates significant aspects of the central speech of the *Timaeus* in order to

establish the exact correspondence between notes and parts of the soul meant by Socrates.

convey a stronger idea that he is following Socrates. Impersonating Timaeus by imitating the structure of his speech might seem a bizarre strategy of self-presentation, but in the dialogue Timaeus is a philosopher who is, in particular, “most astronomical” (not just an astronomer: ἀστρονομικώτατος, *Ti.* 27A4), the very image that Ptolemy wanted to project of himself. Indeed, Timaeus uses musical ratios and astronomical notions in his explanation of the creation of the universe, and therefore would represent a certain fulfillment of the programme of the *Republic*.

Imitation of Timaeus’ speech

To begin with, it is worth noting that Ptolemy’s programme from *Harmonics* 3.4 on, devoted to showing that certain divisions in the human soul are associated with harmonic structures (3.5–7), just as are certain elements of astronomical theory (3.8–16), has an obvious model in Plato’s *Timaeus*. In the dialogue Timaeus defines the world soul as a compound of two circles, made of a diatonic scale (36A–D); the second of these circles (that of the *different*) is divided again and the planets are placed in the resulting orbits (38D). The whole speech builds up an extended analogy between universe and man, so that these very orbits are taken as a representation of human souls,²² which are thus likewise formed out of musical intervals.

This similarity in contents is coupled with clear verbal allusions. A number of linguistic features will already strike the reader in the first lines quoted above, such as the superlative adjectives (καλλίστων, λογικωτάτην)²³ and expressions (πάσης ἀκριβείας, μεγέθους), expressions denoting strong feelings (θεθαυμακέναι, ποθεῖν, ἔρωτος θείου), and a curious phrase, “this world” (τῷδε τῷ κόσμῳ), which is especially common in the

²² Human souls are said to contain orbits, e.g. at *Ti.* 47D.

²³ Superlatives are especially frequent in this chapter (3.3): some lines below we can find the already mentioned “highest and most marvellous” (ἀνωτάτω καὶ θαυμασιωτάταις) applied to sight and hearing, and “most rational” (λογικώταται) applied to astronomy and harmonics.

Timaeus, appearing nowhere else in Plato:²⁴ in the *Timaeus* it is used in connection with the idea, developed from the very beginning of Timaeus' speech, that the world is an imitation of something.²⁵ For their part, superlative adjectives are in fact extremely common throughout this dialogue, constituting the major characteristic of what D. Runia has called "language of excellence."²⁶

However, Ptolemy's imitation of the *Timaeus* is still more remarkable in the general structure of the *Harmonics*. First, it can be argued that Timaeus' speech is, like the *Harmonics*, divided into two parts. At *Ti.* 48B, Timaeus introduces the idea of the "straying cause" (πλανωμένης αιτίας) as a factor accounting for the fact that "Intellect prevailed over Necessity by persuading it to direct most of the things that come to be toward what is best" (νοῦ δὲ ἀνάγκης ἄρχοντος τῷ πείθειν αὐτὴν τῶν γιγνομένων τὰ πλείστα ἐπὶ τὸ βέλτιστον ἄγειν, 48A). At the same time, he introduces the so-called receptacle as a third Form, along with the two proposed at the beginning, the model—intelligible and changeless—and the imitation of the model—the visible universe (48E–49A)—and clearly expresses that this move represents "a different beginning" (ἑτέραν ἀρχήν, 48B2, cf. 48E2) to his discourse, even leading him to call upon the gods again, as at the start (48D).

Ptolemy does not explicitly tell us that 3.3 represents a new beginning, but he does state that his project to find the harmonic ratios with the help of the *kanon* has come to an end (see above). Furthermore, he resumes with the concept of "har-

²⁴ *Ti.* 23A, 29B, 30B, 30D, 48A, 92C; it is also found in authors interested in the *Timaeus*: Philo Alex. *Op.* 9, *Leg.* 3.99, 101, 127; Gal. *De plac.* 9.7.9.; Plot. *Enn.* 2.9.7.

²⁵ Cf. 29E: λέγωμεν δὴ δι' ἥντινα αἰτίαν γένεσιν καὶ τὸ πᾶν τόδε ὁ συνιστάς συνέστησεν [...] πάντα ὅτι μάλιστα ἐβουλήθη γενέσθαι παραπλήσια ἑαυτῷ.

²⁶ D. T. Runia, "The Language of Excellence in Plato's *Timaeus* and Later Platonism," in S. Gersh and C. Kannengiesser (eds.), *Platonism in Late Antiquity* (Berlin 1992) 11–37.

monic power” (ἁρμονικὴ δύναμις) with which he started the whole text (the very first words being ἁρμονικὴ ἐστὶ δύναμις). Crucially, similarly to Timaeus, he introduces at 3.3 a third element in the pair of principles defined at the very beginning: whereas the “main criteria” of harmony were said to be hearing and reason (ἀκοὴ καὶ λόγος, 1.1 [3.4]) in the first lines of the *Harmonics*—hearing related to matter and modification (τὴν ὕλην καὶ τὸ πάθος) and reason to form and cause (τὸ εἶδος καὶ τὸ αἴτιον)—in 3.3 harmony is associated with a third principle, movement (κινήσει, 92.10), which is presented as mediating between matter and form. Furthermore, this movement is immediately linked to cause (τὸ αἴτιον, 92.11), similar to what we see in Timaeus’ new beginning; indeed, the two other principles can be interpreted as very much corresponding to Timaeus’ imitation (matter) and model (form).²⁷ Even the receptacle as described by Timaeus, a winnowing-basket, the motion of which sorts the particles it contains (52E), can be thought of in relation to Ptolemy’s harmony, which “imposes the proper form on the underlying matter” (ὃ τῷ ὑποκειμένῳ περιποιεῖ τὸ οἰκεῖον εἶδος, 92.15).

There are further elements confirming that Ptolemy consciously conceived of *Harmonics* 3.3 as a second beginning. Well before he mentions the science of harmonics in 3.3, he has already presented the subject in Book 1, only more specifically there, stating his view concerning the aim of the harmonicist (1.2 [5.13]). As he does in 3.3, he also compares harmonics with astronomy, and refers to the objects of both sciences, using the Timaeic language of excellence, as “the most beautiful constructions” of nature (ταῖς καλλίσταις κατασκευαῖς, 5.22–23); again, as in 3.3, he makes reference to “the more rational of the senses, sight and hearing” (αἱ τῶν λογικωτέρων αἰσθήσεων, ὄψεως καὶ ἀκοῆς, 5.23–24). Furthermore, the next lines,

²⁷ Barker, *Greek Musical Writings* II 276 n.4, also argues, referring to this distinction at the beginning of the *Harmonics*, that “Ptolemy’s starting point is probably Plato’s *Timaeus*.”

in which Ptolemy contrasts the (according to him) exclusively empirical approach of the Aristoxenians with the too theoretical Pythagoreans, seem to be echoed in the later passage in which he defends a kind of mathematics integrating theory and practice (3.3 [93.5–10], cf. above). Even more specifically, his criticism of the Aristoxenians and the Pythagoreans also alludes to the passage in *Republic* 7 where the science of harmonics is examined (530E–531C), in which both the Pythagoreans and unnamed music theorists are criticized.²⁸

As to the question of how Ptolemy came up with the idea to imitate the structure of the *Timaeus*, a possible inspiration could have been familiarity with the pseudo-Pythagorean treatises, which were known in Alexandria at least by the time of Philo in the first century.²⁹ On a more concrete level, Ptolemy might

²⁸ Barker, *Greek Musical Writings* II 279 n.17. Ptolemy attacks the Aristoxenians partly because they “only make use of a manual technique” (μόνη τῆ χειρουργικῆ χρήσει, 1.2 [5.25]), which seems to match Plato’s criticism of the unnamed theorists who “attach things to their strings and examine them” (τοὺς ταῖς χορδαῖς πράγματα παρέχοντας καὶ βασανίζοντας, *Resp.* 531B3). Significantly, Ptolemy does not criticize the Pythagoreans for the same reason that Plato did—that “they do not make the ascent to problems” (οὐκ εἰς προβλήματα ἀνίστασιν, 531C1); and by his complaint that they “provide a slander to be directed at this sort of criterion by those whose opinions differ” (διαβολὴν ἐμποιῆσαι τῷ τοιοῦτῳ κριτηρίῳ παρὰ τοῖς ἑτεροδόξοις, 1.2 [6.4]), referring to their inaccuracies in the measure of ratios, he implicitly takes sides with them. Even if Ptolemy is here concerned with the mathematical aspect of harmonics, his representative of the Pythagoreans, Archytas, was also the inspiration of Plato’s idea to study music together with astronomy (see n.20 above).

²⁹ Philo *Op.* 12 mentions a pseudo-Pythagorean treatise by one Ocellus Lucanus. Some of these texts repeated doctrines of the *Timaeus*, one of the favourites being the division of the soul (also found in the second part of Ptolemy’s *On the Criterion and the Commanding Faculty*, cf. 704 below): see in H. Thesleff, *The Pythagorean Texts of the Hellenistic Period* (Åbo 1965), Metopus 118, Diotogenes 73, Callicratidas 103, Theages 190; above all, the *Timaeus Locrus* was itself an imitation of the whole speech. It may be significant that two Roman technical writers, Varro and Vitruvius, justified organizational characteristics of their works by reference to Pythagorean practices. Varro *Ling.* 5.10 traces back to Pythagorean contraries (pairs of

have seen parallels between his intended programme and a *Timaeus* passage found shortly before the “new beginning,” where harmony is portrayed after sight as beneficiary to humankind, “not for irrational pleasure” (οὐκ ἐφ’ ἡδονὴν ἄλογον, 47D)—a warning which is also issued by Ptolemy at this point (*Harm.* 3.3 [93.14])—but to bring order to the orbits of our souls. Ptolemy would then have appropriated the idea of the new beginning as a means of going back to the start and re-examining the issue from a more external perspective, as it were ascending to philosophical problems, as prescribed in the *Republic*. The strategy may thus be regarded as an appropriation of a device of the *Timaeus* which in addition could be used to allude to the programme of the *Republic*.

As to using the mathematical section of *Republic* 7 for the composition of a mathematical treatise, Ptolemy had the precedent of Theon of Smyrna, who wrote his *Mathematics Useful for Understanding Plato* with a plan openly based on Socrates’ programme of five parts, beginning with arithmetic and ending with the music of the spheres, with a slight modification which he cared to explain.³⁰ Nicomachus of Gerasa in his *Introduction to Arithmetic* also followed the scheme of sciences of the *Republic*, although more freely than Theon: instead of taking Plato as an absolute authority, he provides his own argument for the con-

opposite concepts such as finite and infinite, life and death, etc.) the four-part division which he applies to many of his treatises: see D. J. Taylor, *Declinatio: A Study of the Linguistic Theory of Marcus Terentius Varro* (Amsterdam 1974) 69–70; for his part, Vitruvius *De arch.* 5 praef. 3 says that to maintain the reader’s attention in a technical book such as his, he will divide the text into short books, of no more than three times 216 lines each, following an allegedly Pythagorean precept.

³⁰ Theon p.24 Dupuis. Theon justified his alteration of Plato’s sequence with practical reasons. He deals with harmonics after arithmetic, while leaving the music of the spheres for last, the music theory alluded to by Socrates in the fifth place as Theon sees it. See recent work on Theon’s physical description of planetary models compared with Ptolemy’s *Planetary Hypotheses* in A. Jones, “Theon of Smyrna and Ptolemy on Celestial Modelling in Two and Three Dimensions,” in V. De Risi (ed.), *Mathematizing Space* (New York 2015) 75–104.

venience of treating arithmetic first among the four Platonic mathematical sciences.³¹

One of Ptolemy's achievements was his application of a Platonic framework to a serious empirical investigation that formed the core of his work.³² This notion that the core of Ptolemy's project lay elsewhere, mathematics in his case, would explain why he very rarely cited his philosophical sources, in contrast with his practice concerning the mathematical authorities. The philosophical tradition was for him a sort of tool-box, which he used in many ways as an intermediary between his readers and the mathematical content.³³ A good parallel for this is Philo of Alexandria, whose main enterprise was biblical exegesis. Philo, like Ptolemy, conceived of Greek philosophy as a tool for his enquiry, and held the *Timaeus* in great esteem, but felt free to disagree with it or to appropriate its doctrines and style in order to explain the sacred text, mostly without further mention.³⁴

³¹ Nicom. *Arithm.* 4. Nicomachus takes precisely the Archytas fragment as a point of departure for his presentation of the four sciences (*Arithm.* 3).

³² Related to this are his efforts to incorporate Aristotelian elements into his philosophical background. Harmonization between Plato and Aristotle is generally considered to be the product of Neoplatonism, but it can already be detected, mainly in the theory of the categories, in Middle Platonists such as Alcinoüs, Plutarch, Eudorus of Alexandria, and the pseudo-Pythagoreans: cf. H. Tarrant, "Eudorus and the Early Platonist Interpretation of the Categories," *LThPh* 64 (2008) 583–595; M. Bonazzi, "Eudorus of Alexandria and the Pythagorean Pseudepigrapha," in G. Cornelli et al. (eds.), *On Pythagoreanism* (Berlin 2013) 385–494. For the integration of Aristotle in Neoplatonism see L. Gerson, "On the Harmony of Plato and Aristotle," in H. Tarrant and D. Baltzly (eds.), *Reading Plato in Antiquity* (London 2006) 195–221. But cf. also the use of Aristotle in the Platonist handbook of mathematics by Theon of Smyrna, including his reliance on the Peripatetic Adrastus of Aphrodisias (n.16 above).

³³ Resonant with this is Ptolemy's argument in *On the Criterion and the Commanding Faculty* (6.3) that dialectic and language in general must be considered as a tool rather than as the end of enquiry.

³⁴ See D. T. Runia, *Philo of Alexandria and the Timaeus of Plato* (Leiden 1986).

Whereas in the *Almagest* Ptolemy chooses the preface as the place to attach the work to a philosophical frame, in the *Harmonics* he includes a similar presentation within a complex system of both micro- and macrotexual structures taken from Plato. The subtle implications of the preface of the *Almagest*, concerning the centrality of mathematics to philosophical discourse, already show remarkable originality, but the procedure in the *Harmonics* is a *tour de force*, unique in its details even if well rooted within the Neopythagorean and Platonic traditions, and comparable to imitative techniques frequent in writers of his time.

Finally, it will be useful to look briefly at two other works of Ptolemy, in which we can observe a procedure of Timaeian imitation similar to that in the *Harmonics*. First, the *Canobic Inscription* ends with an account of the notes that correspond to the planetary spheres, clearly inspired by the *Timaeus*, and probably the same that was displayed in the very last chapters of the *Harmonics*.³⁵ It is possible that the invocation of the god at the beginning of the inscription—probably Sarapis³⁶—“saviour god” (θεῶν σωτήρι), implied a reference to Timaeus’ own invocation at the new beginning of the *Timaeus*.³⁷ Second, the epistemological essay *On the Criterion and the Commanding Faculty* is also divided into two parts, in this case reflected in the title. Most of the section corresponding to the commanding faculty is again based on the *Timaeus* (Ptol. *Crit.* 14, cf. Pl. *Ti.* 69D–71E), consisting of an account of the parts of the soul based on the famous Platonic division and amplified with Aristotelian

³⁵ The three last chapters are not preserved, but Barker, *Greek Musical Writings* II 390 n.89, shows that the notes mentioned in a fragment belonging to 3.16 exactly correspond to those of the *Canobic Inscription*. Cf. C. Tolsa, “Ptolemy and Plutarch’s *On the Generation of the Soul in the Timaeus*: Three Parallels,” *GRBS* 54 (2014) 444–461, for the Timaeian tradition that underlies Ptolemy’s music of the spheres.

³⁶ Jones, *SCIAMVS* 6 (2005) 53.

³⁷ *Ti.* 48D: θεὸν δὴ καὶ νῦν ἐπ’ ἀρχῇ τῶν λεγομένων σωτήρα ἐξ ἀτόπου καὶ ἀήθους διηγήσεως πρὸς τὸ τῶν εἰκότων δόγμα διασφάζειν ἡμᾶς ἐπικαλεσάμενοι πάλιν ἀρχόμεθα λέγειν.

elements.³⁸ There are clear parallels between the beginning of this last section and the text immediately following the second beginning of the *Timaeus*: Ptolemy adduces, like Timaeus, that the so-called elements have to be addressed as a preliminary to the enquiry (*Crit.* 13, *Ti.* 48B, 49B), and actually develops a theory of the elements that, in a much simpler manner than that of the *Timaeus*, also leads to a specific association between the parts of the body and those of the soul. Again, the beginning of the essay might also contain an allusion to the *Timaeus*, this time to the very beginning of it, where Timaeus expounds his concept of the universe as a living being formed out of all the living beings (*Ti.* 30C). Ptolemy begins his text with a similar induction, proposing that the criterion should be derived from the specific criteria contained in it.³⁹

Therefore, pending a closer analysis of the other two cases, it can safely be said that the *Harmonics* is not the only treatise which Ptolemy framed with references to the *Timaeus*, drawing heavily on it in the final sections. The procedure thus seems to have formed part of a rhetorical model of his own which he used in his early works.⁴⁰ However, it is probable that because of the more complex nature of the treatise itself, Ptolemy in the *Harmonics* went farther than in any other tract in his appropriation of the new-beginning structure, imitation of the language, and combination with other items of self-presentation.

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³⁸ A. A. Long, "Ptolemy *On the Criterion*: An Epistemology for the Practicing Scientist," in J. Dillon and A. A. Long (eds.), *The Question of "Eclecticism": Studies in Later Greek Philosophy* (Berkeley 1988) 176–207, at 205.

³⁹ *Crit.* 1: τὸ κριτήριον τῶν ὄντων ἐφοδεύσαμεν ἂν κατὰ τὸ δέον, εἰ παραβάλλοιμεν αὐτὸ κριτηρίοις τισὶ τῶν ἰδίως ὑπ' αὐτὸ τεταγμένων.

⁴⁰ See n.2 for the relative chronology.