BOOK I

CHAPTER I

The ancients, who under the leadership of Pythagoras first made 1
science systematic, defined philosophy [1] as the love of wisdom. In-
deed the name itself means this, and before Pythagoras all who had
knowledge were called 'wise' indiscriminately — a carpenter, for
example, a cobbler, a helmsman, and in a word anyone who was versed
in any art or handicraft. Pythagoras, however, restricting the title
so as to apply to the knowledge and comprehension of reality, and
calling the knowledge of the truth in this the only wisdom, naturally
designated the desire and pursuit of this knowledge philosophy, as
being desire for wisdom.

He is more worthy of credence than those who have given other 2
definitions, since he makes clear the sense of the term and the thing
defined. This 'wisdom' he defined as the knowledge, or science, of
the truth in real things, conceiving 'science' to be a steadfast and firm
apprehension of the underlying substance, and 'real things' to be those
which continue uniformly and the same in the universe and never de-
part even briefly from their existence; these real things [2] would be
things immaterial, by sharing in the substance of which everything
else that exists under the same name and is so called is said to be 'this
particular thing,' [3] and exists.

[1] In his introductory statements Nicomachus does not run counter to widespread beliefs of
ancient times. The origin of the names 'philosophy,' 'philosopher' (φιλοσοφία, φιλόσοφος) was
commonly ascribed to Pythagoras; compare the citations given by Ritter and Preller, *Hist.
Phil. Graec.*, 3, and (Plut.) *Epit.*, I. 3. 8 (= Diels, *Doxographi Graec.*, 280–281). As to the belief
that Pythagoras corrected a wrong use of the terms, compare the following parallel with Nicoma-
chus's statements furnished by Ammonius (*In Porphyrii Isagogen Prooem.*, p. 9, 7): "Pythagoras,
however, says, 'Philosophy is the love of wisdom,' and he was the first to assail the error found
among the ancients; for whereas they would call 'wise' a man who pursued any art whatsoever
. . . he shifted this epithet to God, so as to call him alone wise (God, I mean) and endowed with
wisdom and knowledge of those things that are eternal" (ὁ μέντοι Πυθαγόρας φησί, Φιλοσοφία ἐστὶ
φιλία σοφίας, πρῶτος τῷ παρὰ τοῖς παλαιοτέροις ἐπιστὰς ἁμαρτήματι. ἐπειδὴ γὰρ ἐκεῖνοι σοφὸν
ὠνόμαζον τὸν ἡντιναοῦν μετιόντα τέχνην . . . μεθίστησι τὴν προσηγορίαν ταύτην ἐπὶ τὸν θεὸν ὡς
μόνον ἐκεῖνον καλεῖσθαι σοφόν, τὸν θεὸν φημι, σοφίαν τε καὶ τὴν τῶν ὄντων ἀιδίων ἔχοντα γνῶσιν).

[2] See Part I, p. 92.

[3] τόδε τι: in Aristotle the technical expression for the particular thing of which being is pred-
icated. The principles which Nicomachus calls Pythagorean are here expressed in Platonic and

3 For bodily, material things are, to be sure, forever involved in continuous flow and change — in imitation of the nature and peculiar quality of that eternal matter and substance which has been from the beginning, and which was all changeable and variable [1] throughout. The bodiless things, however, of which we conceive in connection with or together with matter, such as qualities, quantities, [2] configurations, largeness, smallness, equality, relations, actualities, dispositions, places, times, all those things, in a word, whereby the qualities found in each body are comprehended — all these are of themselves immovable and unchangeable, but accidentally they share in and partake of the affections of the body to which they belong.
4 Now it is with such things that 'wisdom' is particularly concerned, but accidentally also with things that share in them, that is, bodies.

CHAPTER II

1 Those things, however, are immaterial, eternal, without end, and it is their nature to persist ever the same and unchanging, abiding by their own essential being, and each one of them is called real in the proper sense. But what are involved in birth and destruction, growth and diminution, all kinds of change and participation, are seen to vary continually, and while they are called real things, by the same term as the former, so far as they partake of them, they are not actually real by their own nature; for they do not abide for even the shortest moment in the same condition, but are always passing over in all
2 sorts of changes. To quote the words of Timaeus, in Plato, [3] "What is that which always is, and has no birth, and what is that which is always becoming but never is? The one is apprehended by the men-

Aristotelian terminology. Late Pythagoreans thus ascribed to their founder much that he never could have said.

[1] Philoponus (*scholia in Nic.*, ed. Hoche) on this passage says that Ammonius criticized Nicomachus for saying that matter is τρεπτὴ καὶ ἀλλοιωτή. "He ought to have said τρεπτικὴ καὶ ἀλλοιωτική, for the changes and variations take place about it; it itself does not change nor vary; for if it itself changed, there would have to be still another matter wherein it would vary and change. And so it is itself unchanging and unvarying, but its forms vary; I mean quantities, qualities, . . ." Philoponus retorts that when change and variation take place, it really is the substrate which we say changes; the forms (qualities, etc.) predicated of it do not change; they pass away and come into being. It is to be noted that, as in the case of Plato, the question of 'primary' and 'secondary' matter can be raised in connection with Nicomachus's doctrines; see p. 93.

[2] See Part I, p. 94.

[3] *Timaeus*, 27 D. Nicomachus closely follows the original, with only minor variations. His quotations of Plato are not usually so exact; cf. I. 3. 5, 7.

tal processes, with reasoning, and is ever the same; the other can be guessed at by opinion in company with unreasoning sense, a thing which becomes and passes away, but never really is."

Therefore, if we crave for the goal that is worthy and fitting for man, 3 namely, happiness of life [1] — and this is accomplished by philosophy alone and by nothing else, and philosophy, as I said, means for us desire for wisdom, and wisdom the science of the truth in things, and of things some are properly so called, others merely share the name — it is reasonable and most necessary to distinguish and systematize the accidental qualities of things.

Things, then, both those properly so called and those that simply 4 have the name, are some of them unified and continuous, for example, an animal, the universe, a tree, and the like, which are properly and peculiarly called 'magnitudes';[2] others are discontinuous, in a side-by-side arrangement, and, as it were, in heaps, which are called 'multitudes,' a flock, for instance, a people, a heap, a chorus, and the like.

Wisdom, then, must be considered to be the knowledge of these 5 two forms. Since, however, all multitude and magnitude [3] are by their own nature of necessity infinite — for multitude starts from a definite root and never ceases increasing; and magnitude, when division beginning with a limited whole is carried on, cannot bring the dividing process to an end, but proceeds therefore to infinity — and since sciences [4] are always sciences of limited things, and never of infinites, it is accordingly evident that a science dealing either with

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[1] The word used by Nicomachus, εὐζωΐα, is once employed by Aristotle in the *Ethica Nicomachea*, I. 8. 1098 b 20 ff.: συνᾴδει δὲ τῷ λόγῳ καὶ τὸ εὖ ζῆν καὶ τὸ εὖ πράττειν τὸν εὐδαίμονα· σχεδὸν γὰρ εὐζωΐα τις εἴρηται καὶ εὐπραξία. The 'happy life,' in a certain definite sense, is the goal that is becoming a man, according to Aristotle. See *ibid.*, I. 10. 1101 a 14 ff., I. 6. 1097 b 25 — 1098 a 20.

[2] On this and the following definitions, and their parallels in Aristotle, see p. 112 and notes.

[3] That is, multitude and magnitude per se and unqualified. This point is noted by Proclus, *In Prim. Eucl. Elem. Lib. Comm.*, p. 6, 15 Friedl.: ὅ τε γὰρ ἀριθμὸς ἀπὸ μονάδος ἀρξάμενος ἄπαυστον ἔχει τὴν αὔξησιν, ἀεὶ δὲ ὁ ληφθεὶς πεπέρασται, καὶ ἡ τῶν μεγεθῶν διαίρεσις ἐπ' ἄπειρον χωρεῖ, τὰ δὲ διαιρούμενα πάντα ὥρισται, καὶ κατ' ἐνέργειαν πεπέρασται τὰ μόρια τοῦ ὅλου. In the *Theologumena Arithmeticae*, p. 3 Ast, also there is reference to this matter in the same terminology: "And it [*sc.* the monad] is evidently beginning, middle, and end of all, since it bounds the infinite division of the continuous in the direction of the smaller than itself, and in the direction of the greater it cuts off a similar increase in the discrete, and this not by our decree, but by that divine nature." This passage is probably Nicomachean. Hero of Alexandria (*Definition* 119, in Hultsch's *Heronis Alexandrini Geometricorum et Stereometricorum Reliquiae*, Berlin, 1864, p. 33) speaks of magnitude as "that which is increased and divided to infinity" (μέγεθός ἐστι τὸ αὐξανόμενον καὶ τεμνόμενον εἰς ἄπειρον).

[4] The matter included in the rest of this section is touched on by Proclus, *op. cit.*, p. 36. 3 Friedl.: ἐπισκοπεῖν δ' αὖ τὸ πηλίκον καὶ ποσὸν οὔτε μέγεθος ἁπλῶς οὔτε πλῆθος ἀλλὰ τὸ καθ

magnitude, per se, or with multitude, per se, could never be formulated, for each of them is limitless in itself, multitude in the direction of the more, and magnitude in the direction of the less. A science, however, would arise to deal with something separated from each of them, with quantity, set off from multitude, and size, set off from magnitude.

CHAPTER III

1   Again, to start afresh, since of quantity one kind is viewed by itself, having no relation to anything else, as 'even,' 'odd,' 'perfect,' and the like, and the other is relative to something else and is conceived of together with its relationship to another thing, like 'double,' 'greater,' 'smaller,' 'half,' 'one and one-half times,' 'one and one-third times,' and so forth, it is clear that two scientific methods will lay hold of and deal with the whole investigation [1] of quantity; arithmetic, absolute quantity, and music, relative quantity.[2]

2   And once more, inasmuch as part of 'size' is in a state of rest and stability, and another part in motion and revolution, two other sciences in the same way will accurately treat of 'size,' geometry the part that abides and is at rest, astronomy that which moves and revolves.

3   Without the aid of these, then, it is not possible to deal accurately with the forms of being nor to discover the truth in things, knowledge of which is wisdom, and evidently not even to philosophize properly, for "just as painting contributes to the menial arts toward correctness of theory, so in truth lines, numbers, harmonic intervals, and the revolutions of circles bear aid to the learning of the doctrines of wis-

ἑκάτερον ὡρισμένον· τοῦτο γὰρ ἀφελούσας τῶν ἀπείρων τὰς ἐπιστήμας κατανοεῖν, ὡς οὐκ ἐνὸν τὴν καθ' ἑκάτερον ἀπειρίαν γνώσει περιλαβεῖν. This he states with regard to Pythagorean mathematics, and in view of the agreement of terminology to be seen here and in the passage cited in the preceding note, it is probable that he used the work of Nicomachus as his authority.

[1] Nicomachus thus subdivides the subject matter and assigns the special fields of the four mathematical sciences: I, treating number (τὸ ποσόν) (1) as such, absolutely (καθ' ἑαυτό), Arithmetic; and (2) relative number (πρὸς ἄλλο), Music; II, treating quantity (τὸ πηλίκον) (1) at rest, Geometry; (2) in motion, Astronomy (σφαιρική). Proclus, op. cit., Prol., p. 35. 21 ff., Friedl., gives the same division of the field of the mathematical sciences, using the same terms, in his report of the Pythagorean mathematics, probably drawing upon this work. It is to be noted that Nicomachus does not in fact adhere strictly to his classification, for he treats in this work of relative number, which falls in the domain of Music, and in the discussion of linear, plane and solid numbers he comes close to Geometry. The classification of Theon of Smyrna (cf. Part I, p. 113, n. 4) includes Music (i.e., the mathematical consideration of harmony) under Arithmetic and avoids this inconsistency.

[2] To illustrate what is meant by relative things Aristotle uses the example of double and half (Met., IV. 15. 1020 b 26).

dom," says the Pythagorean Androcydes.[1] Likewise Archytas of 4
Tarentum,[2] at the beginning of his treatise *On Harmony*, says the same
thing, in about these words: "It seems to me that they do well to
study mathematics, and it is not at all strange that they have correct
knowledge about each thing, what it is. For if they knew rightly the
nature of the whole, they were also likely to see well what is the nature
of the parts. About geometry, indeed, and arithmetic and astronomy,
they have handed down to us a clear understanding, and not least also
about music. For these seem to be sister sciences; for they deal
with sister subjects, the first two forms of being."

Plato, too, at the end of the thirteenth book of the *Laws*,[3] to which 5

[1] He is mentioned as a writer *On Symbols* (περὶ συμβόλων) in the *Theol. Arith.*, p. 40 Ast.

[2] The passage here quoted is found also, at greater length, in Porphyry, *In Ptolem. Harm.*, p. 236; a few words of the same passage appear in Iamblichus, *In Nicomachi Arithmeticam Introductionem Liber*, p. 9, 1 Pistelli; cf. Diels, *Die Fragmente der Vorsokratiker*, vol. I³, pp. 330 ff., and Blass, in *Mélanges Graux*, pp. 574 ff. On Archytas, and the problem of the title of this work, see pp. 20 ff.

[3] The *Epinomis*, from which Nicomachus here quotes 991 D ff., is now recognized as not genuinely Platonic. Nicomachus doubtless cited the passage from memory, for he does not give it exactly; but he can hardly have distorted it as Hoche would make him. The portion of Hoche's text that seems to demand correction is φανήσεται δ' ἂν ὃ λέγομεν ὀρθῶς, εἴ τις εἰς ἓν βλέπων πάντα μανθάνει. This reading introduces a future indicative with ἄν, a construction not elsewhere found in Nicomachus, and one which a writer of his class would not be likely to use, although it occurs in late Greek. Certainly he would not thrust such a palpable modernism into a quotation of Plato. Hoche perhaps has not reported the manuscripts correctly on this passage; his apparatus sometimes is faulty (see Hultsch, in *Neue Jahrbücher für Philologie und Pädagogik*, vol. XCVII, 1868, pp. 762 ff.). I have not had access to the manuscripts, but I note that C. F. A. Nobbe (*Specimen Arithmeticae Nicomacheae*, Leipzig, 1828, p. 19), who used the Nürnburg and Wolfenbüttel manuscripts (N and Γ), omits εἰ here, and that Hoche does not report the fact. Now this word εἰ is the cause of all the difficulty with the text. It did not occur in the original, but it could easily have been inserted by a scribe who misunderstood the preceding ἄν. The familiarity of the phrase εἴ τις would be another motive; ὀρθῶς τις, on the other hand, is unusual. The introduction of εἰ, also, might bring in μανθάνει for μανθάνῃ. I therefore read φανήσεται δ' ἂν, ὃ λέγομεν, ὀρθῶς τις εἰς ἓν βλέπων πάντα μανθάνῃ. The change of the last word is supported by Nobbe's manuscripts, but is not so necessary as the omission of εἰ.

The original passage reads: "Every geometrical figure, system of numbers, composition of harmony and the regularity in the revolution of the stars must appear to one, who properly learns, to be one in principle in all cases; and it will so appear, if, as we say, one learns correctly, looking to one thing. For it will appear to them on consideration that there naturally exists one bond of all these things; and if any one will pursue these matters in another way, he must call to his aid Fortune, as we say. For without these sciences there will never arise a fortunate being in the cities; but this is the mode, this the nurture, these the lessons, whether hard or easy; this way must one proceed, and to neglect them is impious before the gods. . . . And the man that has apprehended all this in this way, this man I call most truly wise, and so I also maintain both in jest and in earnest" (πᾶν διάγραμμα ἀριθμοῦ τε σύστημα καὶ ἁρμονίας σύστασιν ἅπασαν τῆς τε τῶν ἀστρῶν περιφορᾶς τὴν ὁμολογίαν οὖσαν μίαν ἁπάντων ἀναφανῆναι δεῖ τῷ κατὰ τρόπον μανθάνοντι, ἀναφανήσεται δέ, ἂν, ὃ λέγομεν, ὀρθῶς τις εἰς ἓν βλέπων μανθάνῃ· δεσμὸς γὰρ πεφυκὼς πάντων τούτων εἰς ἀναφανήσεται διανοουμένοις· εἰ δ' ἄλλως πως ταῦτα μεταχειριεῖταί τις, τύχην δεῖ καλεῖν, ὥσπερ καὶ λέγομεν. οὐ γὰρ ἄνευ γε τούτων μήποτέ τις ἐν πόλεσιν εὐδαίμων γένηται φύσις,

some give the title *The Philosopher*, because he investigates and de-
fines in it what sort of man the real philosopher should be, in the
course of his summary of what had previously been fully set forth and
established, adds : "Every diagram, system of numbers, every scheme
of harmony, and every law of the movement of the stars, ought to
appear one to him who studies rightly; and what we say will prop-
erly appear if one studies all things looking to one principle, for there
will be seen to be one bond for all these things, and if any one attempts
philosophy in any other way he must call on Fortune to assist him.
For there is never a path without these; this is the way, these the
studies, be they hard or easy; by this course must one go, and not
neglect it.   The one who has attained all these things in the way I
describe, him I for my part call wisest, and this I maintain through

6 thick and thin."   For it is clear that these studies are like ladders
and bridges that carry our minds from things apprehended by sense
and opinion to those comprehended by the mind and understanding,
and from those material, physical things, our foster-brethren known to
us from childhood, to the things with which we are unacquainted,
foreign to our senses, but in their immateriality and eternity more
akin to our souls, and above all to the reason [1] which is in our souls.

7   And likewise in Plato's *Republic*, when the interlocutor of Socrates
appears to bring certain plausible reasons to bear upon the mathemati-
cal sciences, to show that they are useful to human life, arithmetic
for reckoning, distributions, contributions, exchanges, and partner-
ships, geometry for sieges, the founding of cities and sanctuaries, and
the partition of land, music for festivals, entertainment, and the
worship of the gods, and the doctrine of the spheres, or astronomy,
for farming, navigation and other undertakings, revealing beforehand
the proper procedure and suitable season, Socrates, reproaching him,
says : "You amuse me, because you seem to fear that these are use-
less studies that I recommend; but that is very difficult, nay, impos-
sible.   For the eye of the soul, blinded and buried by other pursuits,
is rekindled and aroused again by these and these alone, and it is

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ἀλλ' οὗτος ὁ τρόπος, αὕτη ἡ τροφή, ταῦτα τὰ μαθήματα, εἴτε χαλεπὰ εἴτε ῥᾴδια, ταύτῃ πορευτέον·
ἀμελῆσαι δὲ οὐ θεμιτόν ἐστι θεῶν . . . τὸν δὲ ξύμπαντα ταῦτα οὕτως εἰληφότα, τοῦτον λέγω τὸν
ἀληθέστατα σοφώτατον, ὃν καὶ διισχυρίζομαι παίζων καὶ σπουδάζων ἅμα . . .).
     Theon of Smyrna quotes the first part of this passage, p. 84, 7 ff. Hiller, and the last part,
p. 2, 16 ff.
     [1] A reference to the νοῦς as the highest part of the soul in accordance with the ancient view that
the soul is made up of parts.

better that this be saved than thousands of bodily eyes, for by it alone is the truth of the universe beheld." [1]

CHAPTER IV

Which then of these four methods [2] must we first learn? Evidently, the one which naturally exists before them all, is superior and takes the place of origin and root and, as it were, of mother to the others. And this is arithmetic,[3] not solely because we said that it existed before all the others in the mind of the creating God like some universal and exemplary plan, relying upon which as a design and archetypal example the creator of the universe sets in order his material creations and makes them attain to their proper ends; but also because it is naturally prior in birth, inasmuch as it abolishes other sciences with itself,[4] but is not abolished together with them.

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[1] The original passage (*Republic*, 527 D ff.) reads: "'You amuse me,' said I, 'because you are like one who fears the crowd lest you seem to enjoin useless studies. It is, however, not at all a trifling matter, but a difficult one to believe that in these studies some instrument of every man's soul is cleansed and rekindled, which was being destroyed and blinded by his other pursuits, a thing more worthy to save than countless eyes: for by it alone is truth beheld.'" (ἡδὺς εἶ, ἦν δ' ἐγώ, ὅτι ἔοικας δεδιότι τοὺς πολλούς, μὴ δοκῇς ἄχρηστα μαθήματα προστάττειν. τὸ δ' ἔστιν οὐ πάνυ φαῦλον ἀλλὰ χαλεπὸν πιστεῦσαι ὅτι ἐν τούτοις τοῖς μαθήμασιν ἑκάστου ὄργανόν τι ψυχῆς ἐκκαθαίρεταί τε καὶ ἀναζωπυρεῖται ἀπολλύμενον καὶ τυφλούμενον ὑπὸ τῶν ἄλλων ἐπιτηδευμάτων, κρεῖττον ὂν σωθῆναι μυρίων ὀμμάτων· μόνῳ γὰρ αὐτῷ ἀλήθεια ὁρᾶται). Theon of Smyrna (p. 3, 8 ff. Hiller) quotes this passage.

[2] This group of studies, music, arithmetic, geometry, and astronomy, make up the 'quadrivium,' or, as Boethius, who apparently first used the term, called it, 'quadruvium.' 'Trivium,' to designate the study of grammar, rhetoric, and dialectic, may also go back to his time. See Gow, *op. cit.*, p. 72, note.

[3] Plato also said that arithmetic should be first learned and that it is the basis of all other arts. *Rep.*, 522 C: οἷον τοῦτο τὸ κοινόν, ᾧ πᾶσαι προσχρῶνται τέχναι τε καὶ διάνοιαι καὶ ἐπιστῆμαι, ὃ καὶ παντὶ ἐν πρώτοις ἀνάγκη μανθάνειν. ποῖον; ἔφη. τὸ φαῦλον τοῦτο, ἦν δ' ἐγώ, τὸ ἕν τε καὶ τὰ δύο καὶ τὰ τρία διαγιγνώσκειν. λέγω δὲ αὐτὸ ἐν κεφαλαίῳ ἀριθμόν τε καὶ λογισμόν. ἦ οὐχ οὕτω περὶ τούτων ἔχει, ὡς πᾶσα τέχνη τε καὶ ἐπιστήμη ἀναγκάζεται αὐτῶν μέτοχος γίγνεσθαι; It is interesting to observe parallels to many of the topics of this chapter in Caxton's *Mirrour of the World (Publications of the Early English Text Society*, extra series, vol. CX, pp. 36–37): "The fourth scyence is called arsmetrique. This science cometh after rethoryque, ande is sette in the myddle of the vii sciences. And without her may none of the vii sciences parfyghtly ne weel and entierly be knowen. Wherfor it is expedient that it be weel knowen and conned; ffor alle the sciences take of it their substaunce in suche wise that without her they may not be. And for this reson was she sette in the myddle of the vii sciences, and there holdeth her nombre; ffor fro her procede alle maners of nombres, and in alle thynges renne, come and goo. And no thyng is without nombre. But fewe perceyue how this may be, but yf he haue be maistre of the vii artes so longe that he can truly save the troughe."

[4] Cf. below II. 22. 3. Nicomachus of course refers merely to abolishment in thought. Arithmetic, since it treats of numbers and numerical relations fundamental to the other sciences, is logically prior to them, and if it did not exist they could not exist. Nicomachus uses both προ-

For example, 'animal' is naturally antecedent to 'man,' for abolish 'animal' and 'man' is abolished; but if 'man' be abolished, it no longer follows that 'animal' is abolished at the same time. And again, 'man' is antecedent to 'schoolteacher'; for if 'man' does not exist, neither does 'schoolteacher,' but if 'schoolteacher' is nonexistent, it is still possible for 'man' to be. Thus since it has the property of abolishing the other ideas with itself, it is likewise the older.

3   Conversely, that is called younger and posterior which implies the other thing with itself,[1] but is not implied by it, like 'musician,' for this always implies 'man.' Again, take 'horse'; 'animal' is always implied along with 'horse,' but not the reverse; for if 'animal' exists, it is not necessary that 'horse' should exist, nor if 'man' exists, must 'musician' also be implied.

4   So it is with the foregoing sciences; if geometry exists, arithmetic must also needs be implied, for it is with the help of this latter that we can speak of triangle, quadrilateral, octahedron, icosahedron, double, eightfold, or one and one-half times, or anything else of the sort which is used as a term by geometry, and such things cannot be conceived of without the numbers that are implied with each one. For how can 'triple' exist, or be spoken of, unless the number 3 exists beforehand, or 'eightfold' without 8? But on the contrary 3, 4, and the rest might be

5   without the figures existing to which they give names. Hence arithmetic abolishes geometry along with itself, but is not abolished by it, and while it is implied by geometry, it does not itself imply geometry.

CHAPTER V

1   And once more is this true in the case of music; not only because the absolute is prior to the relative, as 'great' to 'greater' and 'rich'

γενέστερος and πρότερος in this passage with the meaning 'prior.' Aristotle uses the term πρότερος and his logic forms the basis for Nicomachus's present argument. For instance, in *Met.*, 1019 a 1 ff., after discussing several forms of πρότερα and ὕστερα, he has the following: τὰ μὲν δὴ οὕτω λέγεται πρότερα καὶ ὕστερα, τὰ δὲ κατὰ φύσιν καὶ οὐσίαν, ὅσα ἐνδέχεται εἶναι ἄνευ ἄλλων, ἐκεῖνα δὲ ἄνευ ἐκείνων μή· ᾗ διαιρέσει ἐχρῆτο Πλάτων. He also uses the verb συναναιρεῖσθαι ('abolish') as does Nicomachus: e.g., *Met.*, 1059 b 39: ᾗ δὲ συναναιρεῖται τοῖς γένεσι τὰ εἴδη, τὰ γένη ταῖς ἀρχαῖς ἔοικε μᾶλλον· ἀρχὴ γὰρ τὸ συναναιροῦν. Cf. also Iamblichus *In Nicom.*, p. 10, 2 Pistelli.

[1] This form of argument also is Aristotelian, e.g., *Top.*, VI. 6. 17: ἐπιφέρει γὰρ ἑκάστη τῶν διαφορῶν τὸ οἰκεῖον γένος, καθάπερ τὸ πεζὸν καὶ τὸ δίπουν τὸ ζῷον συνεπιφέρει. Logically exhausted it stands in *Top.*, II. 4. 111 a 25 ff. thus: οὐ γὰρ ἀναγκαῖον ὅσα τῷ γένει ὑπάρχει καὶ τῷ εἴδει ὑπάρχειν· ὅσα δὲ τῷ εἴδει ὑπάρχει ἀναγκαῖον καὶ τῷ γένει· ὅσα γὰρ τῷ γένει οὐχ ὑπάρχει, οὐδὲ τῷ εἴδει· ὅσα δὲ τῷ εἴδει μὴ ὑπάρχει, οὐκ ἀναγκαῖον τῷ γένει μὴ ὑπάρχειν.

to 'richer' and 'man' to 'father,' but also because the musical har-
monies, diatessaron, diapente, and diapason, are named for numbers;
similarly all of their harmonic ratios are arithmetical ones, for the
diatessaron is the ratio of 4 : 3, the diapente that of 3 : 2, and the
diapason the double ratio; and the most perfect, the di-diapason,
is the quadruple ratio.

More evidently still astronomy attains through arithmetic the in- 2
vestigations that pertain to it, not alone because it is later than geom-
etry [1] in origin — for motion naturally comes after rest — nor because
the motions of the stars have a perfectly melodious harmony,[2] but also
because risings, settings, progressions, retrogressions, increases, and
all sorts of phases are governed by numerical cycles and quantities.

So then we have rightly undertaken first the systematic treatment 3
of this, as the science naturally prior, more honorable, and more ven-
erable, and, as it were, mother and nurse of the rest; and here we will
take our start for the sake of clearness.

CHAPTER VI

All that has by nature with systematic method been arranged in 1
the universe [3] seems both in part and as a whole to have been deter-
mined and ordered in accordance with number, by the forethought
and the mind of him that created all things; for the pattern was fixed,
like a preliminary sketch, by the domination of number preëxistent [4]
in the mind of the world-creating God, number conceptual only and
immaterial in every way, but at the same time the true and the eternal
essence, so that with reference to it, as to an artistic plan, should be
created all these things, time, motion, the heavens, the stars, all sorts
of revolutions.

It must needs be, then, that scientific number, being set over such 2
things as these, should be harmoniously constituted, in accordance
with itself; not by any other but by itself. Everything that is har- 3

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[1] Plato in *Rep.*, 528 A—B points out that it is a mistake to study bodies (στερεά) in motion be-
fore studying them per se (αὐτὸ καθ' αὐτό).

[2] The music of the spheres. Boethius, I. 1, paraphrases: *quod armonicis modulationibus motus
ipse celebratur astrorum.*

[3] This chapter, with I. 4. 2, gives the fullest information we have about Nicomachus's theories
of cosmogony. See Part I, p. 107.

[4] This is the eternal number, to be distinguished from the ' scientific number' mentioned in the
next section. Cf. Part I, p. 98.

moniously constituted is knit together out of opposites [1] and, of course, out of real things; for neither can non-existent things be set in harmony, nor can things that exist, but are like one another, nor yet things that are different, but have no relation one to another. It remains, accordingly, that those things out of which a harmony is made are both real, different, and things with some relation to one another.

4   Of such things, therefore, scientific number consists; for the most fundamental species in it are two, embracing the essence of quantity,[2] different from one another and not of a wholly different genus, odd and even, and they are reciprocally [3] woven into harmony with each other, inseparably and uniformly, by a wonderful and divine Nature, as straightway we shall see.

CHAPTER VII

1   Number [4] is limited multitude or a combination of units or a flow [5] of quantity made up of units; and the first division of number is even and odd.

2   The even [6] is that which can be divided into two equal parts without a unit intervening in the middle; [7] and the odd is that which cannot be divided into two equal parts because of the aforesaid intervention of a unit.

3   Now this is the definition after the ordinary conception; by the Pythagorean doctrine, however, the even number is that which admits of division into the greatest and the smallest parts at the same operation, greatest in size and smallest in quantity, in accordance

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[1] Note that the definition of harmony quoted from Philolaus in II. 19. 1 implies as much, and compare Part I, pp. 100, 120, on the general subject of harmony in the numerical system.

[2] That is, they are elementary, for they are formed by the two elements of number, the monad and dyad respectively, and embody by reason of this origin 'sameness' and 'otherness,' the fundamental cosmic forces. Cf. Part I, p. 99.

[3] Cf. Theon of Smyrna, p. 23. 3 Hiller: "And the even and the odd numbers alternate, being observed in alternate places" (ἐναλλὰξ δ' εἰσὶν ἀλλήλοις οἵ τε ἄρτιοι καὶ οἱ περιττοὶ παρ' ἕνα θεωρούμενοι).

[4] Cf. Part I, p. 114, on these definitions.

[5] The translation 'flow' for χύμα is that adopted by Heath (Euclid, II. 280), whose note on definitions of number may be consulted. χύμα elsewhere in Nicomachus is used to mean 'series' (see the Glossary), but probably the metaphorical idea is present even in those cases.

[6] Theon of Smyrna, p. 21, 22 Hiller: καὶ ἄρτιοι μέν εἰσιν οἱ ἐπιδεχόμενοι τὴν εἰς ἴσα διαίρεσιν . . . περισσοὶ δὲ οἱ εἰς ἄνισα διαιρούμενοι, κτλ. Euclid defines thus: "An even number is one that is halved" (ἄρτιος ἀριθμός ἐστιν ὁ δίχα διαιρούμενος), Elements, VII, Def. 6.

[7] See Part I, p. 122 with note 1.

with the natural contrariety [1] of these two genera; and the odd is that which does not allow this to be done to it, but is divided into two unequal parts.

In still another way, by the ancient definition, the even is that which 4 can be divided [2] alike into two equal and two unequal parts, except that the dyad,[3] which is its elementary form, admits but one division, that into equal parts; and in any division whatsoever it brings to light only one species of number, however it may be divided, independent of the other. The odd [4] is a number which in any division whatsoever, which necessarily is a division into unequal parts, shows both the two species of number together, never without intermixture one with another, but always in one another's company.

By the definition in terms of each other, the odd is that which 5 differs by a unit from the even in either direction, that is, toward the greater or the less, and the even is that which differs by a unit in either direction from the odd, that is, is greater by a unit or less by a unit.

[1] That is, halves are the greatest possible parts of a term in magnitude; and there is a smaller number of them than of any other fractional part. Thus greater magnitude of factors is associated with a smaller number of them; this is the 'natural contrariety' of magnitude and quantity. Cf. Boethius, I. 4, for a discussion of this notion, and Iamblichus, p. 12, 3 ff. Pistelli. This principle may be illustrated by what was called the "lambdoid diagram" (see Part I, p. 127) from its likeness to the Greek lambda, Λ. This diagram sets forth in the form of the letter lambda, converging at unity, the series of natural numbers and the series of fractions, thus:
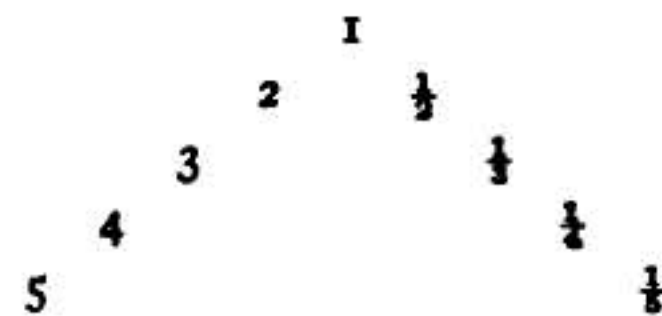
and so on. It will be noted that the corresponding integers and fractions show the 'natural contrariety' referred to. The diagram occurs in Iamblichus's commentary (p. 14, 3 ff. Pistelli) following on the discussion of these definitions, and it is referred to in *Theol. Arith.*, p. 3 (bottom) Ast.

[2] When an even number is divided into two parts, whether equal or unequal, these parts are always either both odd or both even ('only one species of number,' as Nicomachus says). Iamblichus, p. 12, 14 ff. Pistelli. See Heath, *History*, vol. I, p. 70.

[3] Iamblichus (p. 13, 7 ff. Pistelli) notes that the monad is distinguished from all the odd numbers by not even admitting division into unequal parts, and the dyad from the even numbers by admitting division into equal parts only. Theon does not notice this property of the dyad, but discusses at some length the question whether the monad is odd or even (p. 21, 24 ff. Hiller). On Nicomachus's doctrine, that the monad and dyad are both elements of number and not themselves numbers but its 'beginnings,' compare Part I, pp. 116 ff.

[4] If an odd number is divided into two parts these will always be unequal and one odd, the other even ('the two species of number').