

ON 'THE ONE' IN PHILOLAUS, FRAGMENT 7*

Presocratic philosophy, for all its diverse features, is united by the quest to understand the origin and nature of the world. The approach of the Pythagoreans to this quest is governed by their belief, probably based on studies of the numerical relations in musical harmony, that number or numerical structure plays a key role for explaining the world-order, the cosmos. It remains questionable to what extent the Pythagoreans, by positing number as an all-powerful explanatory concept, broke free from Presocratic ideas that certain stuffs or material elements sufficed to account for the source (*ἀρχή*) and constitution of the world, but apparently number found such a universal application with them that Aristotle could summarize the Pythagorean position as 'numbers... are the whole universe' (*Met.* 986a21). Historians of Greek philosophy have generally accepted Aristotle's assessment.¹ Of late, however, certain scholars have argued that the Pythagorean number doctrine is Aristotelian (mis-) interpretation, unjustly foisted upon the Pythagoreans.² Enlisted in support of their arguments are the fragments of Philolaus of Croton. Here we have the foremost representative of fifth-century Pythagoreanism, who states as his basic principles, not numbers exactly, but 'limiters' and 'unlimiteds', and who, it is argued, regards number solely as an epistemological aid for understanding the structure of reality. So Philolaus is called upon as a witness against Aristotle. The rationale goes something like this: Aristotle most likely had written sources for his knowledge of Pythagorean teachings; the only texts we know of with any certainty are Philolaus' book and the writings of Archytas; since Aristotle treats Archytas separately, he is mainly relying on Philolaus; because Philolaus does not expressly state that things are numbers, Aristotle's interpretation is wrong.³

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¹ See Zeller-Nestle, *Die Philosophie der Griechen I* (Leipzig, 1923⁷), pp. 446ff.; J. Burnet, *Early Greek Philosophy* (London, 1930⁴), pp. 286ff.; W. Kranz, *Die griechische Philosophie* (Birsfelden-Basel, 1955), pp. 41f., 48; W. K. C. Guthrie, *A History of Greek Philosophy I* (Cambridge, 1962), pp. 229ff.; J. Barnes, *The Presocratic Philosophers* (London, 1982, rev. ed.), pp. 380ff. These and the following works will subsequently be referred to by the name of the author alone: O. Becker, *Das mathematische Denken der Antike* (Göttingen, 1966²); A. Boeckh, *Philolaos* (Berlin, 1819); W. Burkert, *Lore and Science in Ancient Pythagoreanism*, E. L. Minar, Jr. (trans.) (Cambridge, MA, 1972); H. Cherniss, *Aristotle's Criticism of Presocratic Philosophy* (Baltimore, 1935); E. Frank, *Plato und die sogenannten Pythagoreer* (Halle, 1923); C. H. Kahn, 'Pythagorean Philosophy before Plato' in A. P. D. Mourelatos (ed.), *The Pre-Socratics* (Garden City, NY, 1974), pp. 161–85; G. S. Kirk, J. E. Raven and M. Schofield, *The Presocratic Philosophers* (Cambridge, 1983³); M. C. Nussbaum, 'Eleatic Conventionalism and Philolaus on the Conditions of Thought', *HSCP* 83 (1979), 63–108; J. A. Philip, *Pythagoras and Early Pythagoreanism* (Toronto, 1966); W. D. Ross, *Aristotle's Metaphysics* (Oxford, 1924); J. Stenzel, *Zahl und Gestalt bei Platon und Aristoteles* (Darmstadt, 1959³); M. C. Stokes, *One and Many in Presocratic Philosophy* (Washington, DC, 1971); L. Ya. Zhmud', 'All is number?' 'Basic Doctrine of Pythagoreanism reconsidered', *Phronesis* 34 (1989), 270–92.

² See C. A. Huffman, 'The role of number in Philolaus' philosophy', *Phronesis* 33 (1988), 1–30, incorporated in his recent book, *Philolaus of Croton* (Cambridge, 1993) (references to Huffman from now on will be to his book). For a similar perspective, but arrived at independently from Huffman, see L. Ya. Zhmud', 270–92. Much of the confidence for the critique of Aristotle is derived from Cherniss' book.

³ In this, however, the critics of Aristotle differ from Cherniss (p. 37, n. 140, 386), who considered the fragments of Philolaus spurious and of no bearing on Aristotle.

These introductory remarks are to provide the larger context of the following discussion, which has as its primary focus one Pythagorean fragment. I have singled out fragment 7 of Philolaus because, when rightly interpreted, it seems to pose a stumbling-block for those who detract from the importance of number, as both an epistemological *and* ontological concept, in the Pythagorean world-view. Although I do not presume that the re-examination of a single fragment (which of course entails the consideration of other Philolaic fragments as well as relevant reports in Aristotle) will suffice to clear away the uncertainties regarding number in the Pythagorean system—there are simply too many unknowns for that ever to be the case—nor answer all the objections of the detractors of number, yet it should make us pause before we radically revise our understanding, imperfect as it may be, of fifth-century Pythagoreanism.

There is more to be said by way of introduction, but first we need to introduce the fragment itself and the interpretative problems that it raises.

τὸ πρῶτον ἀρμοσθέν, τὸ ἐν, ἐν τῷ μέσῳ τᾶς σφαίρας ἐστία καλεῖται.⁴

The first thing fitted together, the one, in the middle of the sphere is called the hearth.

The cosmogony of Philolaus begins with the construction of the central fire, the Pythagorean hearth of the universe. Since 'nature in the cosmos was fitted together (ἀρμόχθη) both from unlimited and limiting things, both the whole cosmos and everything in it' (fr. 1), this 'first thing fitted together' or harmonized must also be a product of the basic principles. C. A. Huffman, in his recent and valuable edition of the fragments, suggests that fire itself as quantitatively or spatially undetermined stuff can be viewed as the unlimited principle, while the middle of the sphere as the spatial determinant of the fire's position can be called the limiting principle (p. 42).⁵ This is plausible, though I have to add two qualifications that would not be accepted by Huffman. First, although the surviving fragments do not state what the unlimited and limiting things are, from Aristotle we learn that the Pythagoreans identified the limited with the odd, and the unlimited with the even elements of number, and I take it that this quite possibly applies to Philolaus as well (see I init.).⁶ In regard to fr. 7, this would mean that the fire is to be identified with the unlimited/even and its central position with the limiting/odd elements of number; both even and odd, as we will see, comprise the one. Secondly, it must be understood that once the unlimited fire has been limited by its position in the centre of the sphere, the role of the central fire becomes itself a limiting one in the on-going formation of the cosmos (see III). My main point of dispute, however, concerns Huffman's interpretation of the unity that results from limiters and unlimiteds, the one; *contra* Huffman, I still think τὸ ἐν refers to the number, the arithmetical unit.⁷

⁴ Stob. 1.21.8 = DK 44B7. With Burkert, p. 255, n. 83, I am assuming that ἐν is not dittography with the following ἐν, mainly because of Aristotle's testimony about the construction of the Pythagorean one—τὸ ἐν (*Met.* 1080b20, cf. 1091a15). Huffman, p. 228, also accepts ἐν though not, as we will see, its identification with number.

⁵ Huffman admits that fire and 'middle' might seem 'features of the cosmos in radically different senses', but his mitigating point that Philolaus was a Presocratic author like Anaxagoras and Empedocles who could write about Mind and Love/Strife as cosmic components has some force.

⁶ So also Kirk, Raven and Schofield, p. 326. This possibility and others—empty spaces and atoms, or material components and their defining shapes—are briefly reviewed and dismissed by Huffman, pp. 37ff.

⁷ On the Greek notion of number, see n. 14 below; on the special status of the one, see further, n. 20 below.

Huffman views the one in fr. 7 against the background of such Presocratic philosophers as Heraclitus and Empedocles, who emphasized a cosmic unity resulting from a *harmonia* of different or opposing elements. In the assertion of Melissus (DK 30B8) that if there were a plurality of beings these would have to be 'exactly such as I say the one ($\tau\omicron\delta\ \epsilon\iota\nu$) to be' Huffman even finds a parallel for the use of the article in Philolaus (leaving aside of course Melissus' Eleatic monism). In the light of the Presocratic tradition then 'the most natural interpretation of the one in Philolaus is simply as referring to a concrete unity of disparate elements (i.e. the central fire) with no reference at all to an arithmetical unit' (p. 208, see also p. 228).⁸ Concerning the central fire specifically, as Huffman goes on to explain, it 'is called the one in so far as it is the primeval unity, the paradigm case of unity in the cosmos' (p. 211). Huffman argues that the scholars who see the one in Philolaus as an arithmetical unit have been led astray by Aristotle's reports on the Pythagoreans in which he speaks of the generation of the one as 'a monad with position' or 'magnitude' (pp. 61, 204). Huffman's own interpretation is shaped by his conviction, based upon his reading of the Aristotelian testimonies, that the Pythagoreans did not equate mathematics with physical and sensible bodies: 'Instead the doctrine represents Aristotle's own succinct formulation of the Pythagorean outlook. He is saying that what Pythagorean philosophy *amounts to* is the doctrine that all things are numbers' (p. 59, his emphasis; *sim.* p. 179). And, since Huffman believes that Philolaus was the main source for Aristotle's comments about Pythagoreanism, he is at particular pains to exempt his philosopher from charges of a doctrine that Aristotle held up for criticism and even ridicule.

Huffman's claims for Philolaus and Pythagoreanism are on the whole well argued and cautiously presented. I do not want to dispute that Aristotle had access to Philolaus' book. In my view Philolaus was an important source for Aristotle's knowledge of Pythagoreanism, but not the sole fountain from which he drew, and therefore it is quite likely that possible distinctions between Philolaus and other Pythagoreans are blurred in Aristotle's extant accounts.⁹ That, however, does not

⁸ Similarly, L. Ya. Zhmud', 276, n. 22.

⁹ The *opinio communis* holds there were no Pythagorean writings before the appearance of Philolaus' book; cf. Guthrie, p. 155; Burkert, pp. 223–38, 239; Huffman, p. 15. From this it is often inferred that when Aristotle makes some definite statement about Pythagoreanism, he is relying on a written source, which therefore must have been Philolaus' book (Archytas is left aside in this reckoning, since Aristotle appears to have devoted special treatises to him); see, for example, Kahn, pp. 170ff. Although there are indisputably important points of contact between Aristotle's testimonies and what we know of Philolaus' book, it is hazardous to assume, especially in the light of what we *do not* know, that there could not have been other Pythagorean sources of information, if not written then oral, available to Aristotle; cf. Philip, p. 120. (I do not place much stock in Diogenes Laertius' assertion (8.15), probably based on Aristoxenus, that until Philolaus nothing could be known of Pythagorean teaching; the most this tells, in the context of the surrounding claims, is that Pythagorean teachings first become expressed in writing with Philolaus.) Thereby the oral reports need not have been confined to *acusmata*, i.e. Pythagorean lore and wisdom (*pace* Burkert, p. 240), but may well have contained something about Pythagorean number philosophy. And because Aristotle, in his surviving works, was not concerned to give a systematic account and critique of Pythagorean philosophy (most likely reserving such an account for his separate treatise on the Pythagoreans; on the pointers thereto, see Guthrie, p. 215, n. 1) but adduces the Pythagoreans to illustrate their views on certain topics and, more often than not, quickly dismisses them again, it is feasible that these incidental reports contain some conflated material. The difficulty then arises in trying to sort out what pertains to Philolaus and what to other Pythagoreans. Relatively certain traces of Philolaus in Aristotle are succinctly summarized by Burkert, p. 234, n. 83; cf. Kirk, Raven and Schofield, pp. 330f., with criticism by Huffman, pp. 58f.

mean that Aristotle misrepresented the essential point about Pythagorean doctrine—the equation of substances and numbers. Here I remain unconvinced by Huffman's general thesis that the Pythagoreans, including Philolaus, did not identify things with numbers. The present paper cannot present all the counter-arguments to this thesis, but if it can show on the basis of fr. 7 that Philolaus identified the centre of the cosmos with the one, understood as number, we will at least have found one major support for the belief that the Pythagoreans fused physical objects and mathematical in a way that Aristotle found objectionable. To be sure, we will then be stuck with the problem of how to understand the Pythagorean/Philolaic identification of things with numbers. That problem we will address at the end of the paper when we have had the benefit of the intervening discussion. So first I offer some arguments, or at least, as our German colleagues would say, 'Anhaltspunkte', for reinstating the one *as number* in fr. 7. These points, stated briefly, will treat the role of number (I), the nature of the one (II), the limiting function of the one (III), and the one as principle (IV).

I

I begin with fr. 4, which can be taken as a programmatic statement for all recognizable constituents of Philolaus' cosmos: 'And indeed all things that are known have number. For it is not possible that anything whatsoever be understood or known without this.'¹⁰ In the next fragment (5) number itself is analysed in a thoroughly Pythagorean vein as consisting of 'two proper kinds, odd and even, and a third from a mixture of both of these, even-odd. Of each of the two kinds there are many forms, which each thing itself signifies.'¹¹ With this fragment one commonly compares Aristotle's report on the Pythagorean analysis of number: 'The elements of number are the even and the odd, and of these the latter is limited and the former unlimited. The one is of [= comes from] both of these (for it is both even and odd), and number is of [= comes from] the one, and numbers, as has been said, are the whole universe' (*Met.* 986a17–21).¹²

As Aristotle presents the evidence for the Pythagoreans, they identified the odd with the limited, and the even with the unlimited. Although the extant fragments of Philolaus do not tell us if he made the same outright identification, the striking similarity between fr. 5 and Aristotle's report makes it quite likely that he did. Even if we take a more guarded approach, nothing forbids us from supposing a 'correspondence' (as even Huffman allows) between his basic principles of unlimiteds and limiters and the odd and even kinds of number. If all known things 'have number', and the constituents of the cosmos are limiters and unlimiteds and combinations thereof, one can expect the cosmic constituents to have their numerical 'counterparts' in the odd or even forms of number, or in the combination of the even-

¹⁰ καὶ πάντα γὰρ μὰν τὰ γινωσκόμενα ἀριθμὸν ἔχοντι. οὐ γὰρ ὅτιών (οἰόν) τε οὐδὲν οὔτε νοηθῆμεν οὔτε γνωσθῆμεν ἀνευ τούτω. Whatever the ordering of the fragments, I call fr. 4 programmatic because it is instructive for any assertion about knowledge in Philolaus.

¹¹ ὁ γὰρ ἀριθμὸς ἔχει δύο μὲν ἴδια εἶδη, περισσὸν καὶ ἄρτιον, τρίτον δὲ ἀπ' ἀμφοτέρων μιχθέντων ἀρτιοπέριτον. ἐκατέρω δὲ τῷ εἶδεος πολλὰ μορφαί, ἃς ἕκαστον αὐτὸ (αὐτό Huffman: αὐταντό mss.) σημαίνει. When Philolaus says that of the two proper kinds of number there are many forms that are signified by each individual thing, he implies that there are not many forms of the third kind (this seems to me an obvious implication; cf. Burkert, p. 264, n. 24). In fact, as I will go on to argue, there is only one form of the even-odd and hence only one thing which 'signifies' it. The various possibilities of numerical interpretation offered by fr. 5 are summarized by Becker, pp. 45f.

¹² Huffman, p. 178, adduces this passage (except for the last clause, 'numbers... are the whole universe') to vouch for the authenticity of Philolaus fr. 5.

odd.¹³ From Aristotle we also learn the exact identity of Philolaus' third kind of number, the even-odd; it is of course the one. Before taking up the place of the even-odd, i.e. the one, in Philolaus' philosophy, let us briefly consider the question of what he may have meant by saying things 'have number'.

First, the phrase itself. For the Greeks, 'to have number' means 'to have count' and thus usually points to an ordered plurality of things or to a whole seen under the aspect of its parts.¹⁴ According to the common Greek notion, then, 'one' is not a number, since a single entity is exempt, as it were, from the necessity of being counted.¹⁵ For the Pythagoreans, however, the one could be understood as number, in so far as it has constituent parts (odd and even, limited and unlimited).

As to the nature of the connection between things and numbers in Philolaus, the fragments give us no explanation in the precise terms that we would desire. (I leave aside for the moment fr. 7 whose ontological purport I take to be clear, but even here Philolaus does not explain why he labels the central fire as the one.) Fragment 4, however, does indicate at the least that for things 'to have number' is a requirement for their intelligibility. Huffman emphasizes solely this epistemological connection between numbers and phenomena; the knowledge of things is ensured by means of their mathematical structure: "'having number"...may well mean "having a structure that can be described mathematically"' (p. 71). In his discussion proper of *ἀριθμὸν ἔχοντι* Huffman follows to an extent Burkert's careful exegesis of the phrase, citing many of the same examples as Burkert, notably from the Hippocratic corpus (pp. 173ff.). But Burkert also makes the important point that for the Presocratics the 'categories of "having" and "being" are not yet strictly separated' so that "'everything has number" means about the same as "everything is, basically, number"' (pp. 266f.). Although Burkert does not appear to ascribe to Philolaus this literal identification ('Philolaus, however, explicitly refused to make any pronouncement about "being" [*ἔστω*] and is for that very reason more free to follow up the *many* relationships of numbers—the meaning of *ἀριθμὸν ἔχειν*', p. 267, my emphasis), he at any rate allows us to understand that for things 'to have number' is an ontologically ambiguous phrase at this period in Greek thought. This observation contributes to my apprehension about accepting the fine distinctions between ontology and epistemology that Huffman believes he recognizes in Philolaus.¹⁶

Huffman, though, repeatedly warns that the link between things and numbers is not at all an ontological one.¹⁷ What the fragments suggest 'is a parallelism between two

¹³ The objections of Barnes, p. 390, to the connection between unlimiteds/limits and even/odd in Philolaus have been adequately met by Huffman, pp. 182f.

¹⁴ The clearest discussion of *ἀριθμός* is that of Nussbaum, 89ff. The Pythagoreans, as we will discuss at the end of this paper, never divorced number from that which was counted.

¹⁵ As Nussbaum, 90, notes parenthetically: 'Thus zero is not an *arithmos*, even in Greek mathematics, since there is no such thing as a null group to be counted; there is a great deal of debate even about *one*, since we do not count the unitary.'

¹⁶ Furthermore, Huffman's sole emphasis on the epistemological role of number for recognizing the structure of things is to put number on a simple, predicative level, which would invalidate Aristotle's criticisms of the Pythagorean understanding of number as substance and in effect obliterate an important difference between him and the Pythagoreans. Cf. K. Gloy, 'Aristoteles' Theorie des Einen auf der Basis des Buches I der "Metaphysik"', in K. Gloy and E. Rudolph (edd.), *Einheit als Grundfrage der Philosophie* (Darmstadt, 1985), p. 92: 'Dadurch, daß das Eine nicht wie nach pythagoreischer Ansicht das Wesen des Seienden ausmacht, sondern dessen Struktur, begleitet es alles Seiende, was Aristoteles auch so ausdrückt, daß die Zahl Zahl von etwas ist.'

¹⁷ Cf. p. 182: 'Things give signs of numbers which gives us knowledge of those things, but things are not therefore said to be numbers, nor are unlimiteds said to be even numbers or the

sets of concepts which are in fact used in separate domains. Limiters and unlimiteds are used when discussing the basic principles of the cosmos and all the things in it, and in cosmology, while the even and the odd come in as part of the discussion of the role of number in explaining how things can be known' (p. 181; *sim.* pp. 39, 72). Although the epistemic role of number—that each thing signifies a certain number that somehow enables us to understand the thing itself—appears to be beyond doubt, the demarcation that Huffman draws between discussions having to do with cosmological principles and those having to do with number and knowledge seems to me too radical.¹⁸ Even fragments that deal mainly with first principles (of an ontological kind) involve assertions of an epistemological nature and thus point indirectly to the presence and use of number.

Fragment 6 offers a good example. Its main theme is nature and cosmic harmony, and while it reserves eternal being and nature itself as prerogatives of divine and not human knowledge, it adds the qualification that none of the things that are and 'are known by us' (*γινωσκομένων ὑφ' ἀμῶν*) could have come to be without the pre-existence of limiters and unlimiteds. Here I follow to an extent Huffman's interpretation (pp. 135f.), which keeps close to the manuscript reading, that Philolaus is speaking about the conditions necessary for things to come to be rather than those necessary for things to come to be known, yet even on this reading we still have the assertion that the things that are—an ontological statement—are known by us (and require the pre-existence of limiters and unlimiteds). The phrase 'known by us', in the context of the fragment, certainly presents a contrast to the things known to the gods alone, but at the same time any declaration about human knowledge in Philolaus must also imply the knowledge of number, given the programmatic statement of fr. 4: 'And indeed all things that are known (*τὰ γινωσκόμενα*) have number. For it is not possible that anything whatsoever be understood or known (*γνωσθήμεν*) without this'. Huffman's observation that 'number is only explicitly introduced in connection with the problem of knowledge (F4)' (p. 181) is correct in so far as fr. 6 (as well as fr. 1 and 2) makes no mention of number or the odd and even. These, in my view, are implicit in the things 'known by us', whose coming-to-be presupposes the existence of limiters and unlimiteds, principles that numerically translate into the odd and even. Huffman's claim, however, cannot stand as such if we are unwilling to jettison a reference to number in the cosmogonical fr. 7. This brings me back to the one.

II

Aristotle, as we saw above from *Met.* 986a17–21, furnishes good evidence that the even-odd in Philolaus fr. 5 is the one.¹⁹ The same passage also offers the most plausible explanation of how the one came to be called even-odd by the Pythagoreans: the one is the starting-point of the number series. In this sense the one stands apart from the numbers to which it gives rise, that is, it cannot be identified exclusively with

limiters said to be odd numbers, although we may come to know them through seeing the even and odd numbers to which they point.' Cf. also p. 56. Similarly, L. Ya. Zhmud', 275.

¹⁸ Huffman's ordering of certain fragments in his book under the separate rubrics of 'Basic Principles', 'Epistemology', and 'Cosmogony' has its organizational usefulness, though it does tend to detract from seeing the close interrelatedness of the topics treated in those fragments.

¹⁹ This is the standard interpretation of the even-odd in early Pythagoreanism, also followed by Huffman (pp. 186f.), in preference to the alternative but weaker interpretation that the even-odd refers to even numbers whose halves are odd (thereto Zeller-Nestle, p. 455, n. 1; cf. Becker, p. 46).

any of the other numbers that must be either odd or even, but, in the words of Philolaus (fr. 5), it is a 'mixture of both of these' (*ἀμφοτέρων μυχθέντων*).²⁰ (It must be added, however, that in actual usage, for example in the octave [1:2], the Pythagoreans seem to have treated the unit as odd and limiting; this applies, as we will see below, to Philolaus' cosmogony as well.)

That the one generates the number series is rejected by Huffman as Aristotelian interpretation 'since, although F5 does present the "even-odd" as derived from the even and the odd, it certainly does not suggest that this "even-odd" generated the rest of the numbers. The even and odd are not in fact presented as "principles" of number in F5, but rather as simply "kinds" of number' (p. 186). Fragment 5 may not suggest the even-odd generated the number series but it also does not rule it out; and the fact that the even and odd are described as 'kinds' of numbers rather than principles does not seem to me an absolute argument against seeing their origin in the third kind of number, which is after all composed of both even and odd.²¹ The semantics of the passage in Aristotle does not otherwise appear to disturb Huffman, seeing that he is content to recognize the even and the odd, which Aristotle designates as the Pythagorean 'elements' (*στοιχεῖα*) of number, as the 'kinds' (*εἶδη*) spoken of by Philolaus.

The most, then, that Huffman accepts from *Met.* 986a17–21 as helpful evidence for understanding Philolaus is the correspondence of odd and even with limiters and unlimiteds and the identification of the even-odd with the one.²² If, however, we understand the even-odd as the one, must we admit with Zeller that we could hardly expect Philolaus to describe it as a separate species?²³ To meet this objection Huffman

²⁰ Cf. Guthrie, p. 240. (On the absence of zero, which gave the one a 'ganz besondere metaphysische Stellung', see Stenzel, pp. 28, 34.) This explanation is preferable to another ancient explanation that says that when the unit is added to an even number, an odd number results, and when added to an odd number it makes it even. As Guthrie, p. 244, points out, this is unsatisfactory 'since it applies to every odd number as much as to the unit' (so also Huffman, p. 186). Moreover, since this explanation holds for every odd number, it would contradict the implication made by Philolaus in fr. 5, to wit, that there are not many forms of the even-odd kind of number.

²¹ A more weighty objection is pointed out to me by Lawrence Schrenk: if the one is a mixture of odd and even, this seems to imply that the one is ontologically posterior to its components, which would contradict its being the starting-point of the number series. Schrenk therefore suggests that, if evens and odds are unlimiteds and limiters, the even-odd refers to the whole mixed class of things (fr. 2), e.g. the world and its contents harmonized from unlimiteds and limiters (fr. 1). While Schrenk's suggestion has its attractiveness (see also now his article, 'World as Structure: The Ontology of Philolaus of Croton', *Apeiron* 27 [1994], 171–90), it still leaves me with the question what place and function to assign to the individual things that give signs of the many forms of odd and even (fr. 5), if the world and the things in it are wholly constituted of the mixed class (hence Huffman terms the one as even-odd a 'symbol of unity' for the mixed class of things; see n. 28 below). But given the existence of odds and evens in the world, Philolaus may have introduced them *a posteriori* to explain the composition of the one. I am not certain that the implied ontological posteriority of the one, and the logical problem this might entail, was at all an issue with him.

²² To accept more would appear to go against the grain of Huffman's thesis, seeing that the numbers resulting from the one are equated by Aristotle with the physical existents of the world ('numbers... are the whole universe', cf. *Met.* 985b32, 987b28, 1090a20). This has been a line of interpretation followed by most scholars; see, e.g. Zeller-Nestle, p. 478 (quoted in n. 49 below), Philip, pp. 51ff., 61.

²³ 'Unter dem ἀρτιοπέρισσον ist entweder das Eins zu verstehen, welches von den Pythagoreern so genannt wurde..., von dem man allerdings kaum erwarten sollte, daß es als eigene Gattung bezeichnet würde, oder diejenigen geraden Zahlen, die durch zwei geteilt ungerade ergeben', Zeller-Nestle, p. 455 n. 1; against the latter alternative, see n. 19 above.

points to the concordant musical intervals, expressed by numerical ratios (2:1, 3:2, 4:3), as examples of the third kind of number, since these are combinations of odd and even (pp. 189f.).²⁴ But if, as has been suggested, we accept that the derivation of number from the one, as presented by Aristotle, holds for Philolaus too, the numbers used in the ratios are examples of the use of whole numbers that arise from the one;²⁵ and their combinations are 'harmonizations' (as one may presume most things are in Philolaus' cosmos) of limiters and unlimiteds, that is, of limiting (odd) and unlimited (even) numbers.²⁶ The point is that only the one is *per se* even-odd, though it originates the even and the odd series of numbers. Against Zeller it may be argued that the even-odd can be described as a 'separate species' precisely because it is 'one of a kind', *sui generis*.²⁷ And accordingly there can only be one thing in the cosmos that points to the one, that 'has' this number.²⁸

In fr. 7 the first thing fitted together, the central fire, is described as the one. Huffman adduces this fragment in support of equating the even-odd in fr. 5 with the one, in line with Aristotle's suggestion, but adds the following qualification: '... this is not a reference to the number 1, as Aristotle takes it to be, but it is an assertion that unities arise from the "fitting together" of dissimilar elements (limiters and unlimiteds). Thus, it would make sense that the number which symbolizes unity, the one, should be regarded by Philolaus as also a combination of dissimilar elements, even and odd' (p. 187).²⁹ Let the one be a symbol of unity, but this is no reason why the one mentioned in fragment 7 should not also and primarily be the number.³⁰ I think we can dispense with the contortions Huffman undergoes to deny this and frankly admit a clear reference to the number one in our fragment.³¹

²⁴ This conjecture has the merit of drawing its examples from something discussed by Philolaus (fr. 6a). With the octave (2:1) Huffman notes a problem 'since 1 is not simply an odd number, but it does contain the principle of the odd in it according to Philolaus'. But, as I will argue below, the Pythagoreans in actual practice gave a delimiting function to the one, effectively treating it as odd. Philolaus was no exception.

²⁵ The emphasis is thus not on the proportion signified by the ratios but on the use of number as such. Cf. Burkert, p. 400: 'Not from Philolaus alone does it become clear that the important thing in Pythagorean musical theory was not the function of the proportion but the meaningful numbers.' Similarly, M. L. West, *Ancient Greek Music* (Oxford, 1992), p. 236. See also n. 43 below.

²⁶ Whereby, as already noted, the unit has to function simply as odd.

²⁷ There is no compelling philological reason against this use of *εἶδος* (before Aristotle takes it up) to refer to a single kind of thing.

²⁸ Huffman, p. 189, speaks of the one as 'the symbol of unity' and adds '... granted that the one as even-odd is an excellent symbol for the whole mixed class of things, it cannot serve to give us knowledge of the great variety of things in the mixed class of things; they cannot all be known through the same number one or they would all be the same' (hence Huffman goes on to give as examples the ratios of the musical concords). While I will grant that the one can be loosely seen as a 'symbol' for all kinds of unities, this does not commit me to the proposition that the whole mixed class of things can be known through the one, since in my view there is strictly speaking only one form of the even and odd and therefore, in a strict sense again, only one thing known through the one.

²⁹ 'as Aristotle takes it to be' in this quotation refers to *Met.* 1091a13ff., which Huffman sees as a commentary on fr. 7 (see n. 34 below). I will return to this passage in Aristotle.

³⁰ Cf n. 28 above. When we assign the one as number to the central fire, its symbolic value may be clear to us but not necessarily to the Pythagoreans. As will be discussed at the end of the paper, for the Pythagoreans numbers were not merely symbols but actually identified with that for which they stood.

³¹ I do not mean to be unkind to Huffman's reasoning, the motivations for which I understand, but it does seem to me contorted to try to garner support for an understanding of the even-odd as the number one by pointing to a fragment in which something is described as the one but then to forbid this to be a reference to the number one, presenting it instead as a unity merely symbolized by the number, while emphasizing that the dissimilar elements that

If all known things have number (whereby we do well to remember the ambiguity of ἀριθμὸν ἔχειν), there can be from the outset no objection to Philolaus' having assigned to or even identified the central fire with a number. It certainly meets the condition of being one of the things known; it can reasonably be included as one of the things that Philolaus says in fr. 6 (discussed above), 'are known by us to have come to be' (γεγενῆσθαι) in the construction of the cosmos. In fact, it is the first thing (τὸ πρῶτον) that comes to be as a result of harmony; its position in the middle of the sphere accords with the testimony about Philolaus that he called the centre 'first by nature'—πρῶτον... φύσει (A16);³² and it is also the starting-point for the further development of the cosmos, which develops from the centre outwards (see fr. 17 and Huffman's commentary, pp. 42, 215ff.). Now given that the one, in the Pythagorean scheme of things, is the first number generated and itself serves as the starting point for the rest of the numbers, it is the number whose properties most correspond to the 'first thing fitted together'. Huffman, as stated at the beginning of this paper, will only allow the central fire to be called the one 'in so far as it is the primeval unity, the paradigm case of unity in the cosmos'. I say that the central fire is called the one because, given that all known things have number, the number one is the appropriate number for Philolaus to identify with the starting-point for a cosmos that taken as whole he calls one (ὁ κόσμος εἰς ἑστίν, fr. 17 init.). Therefore, while I agree that the central fire as the first thing harmonized can be seen as a paradigmatic unity, I cannot follow Huffman when he denies it to be the specific number that best represents unity and that as both odd and even carries within it the seed(s), so to speak, of all the numbers assigned to things in the Philolaic cosmos, especially as odd and even correspond to the principles (limiters and unlimiteds) already at work in the harmonization of the first cosmic component. Again, if 'having number', according to Huffman's own definition, means 'having a structure that can be described mathematically' (p. 71), I can find no better mathematical description of the central fire's structure than the one. This seems to me still the most natural interpretation of fr. 7.³³

combine to form both (the central fire and the unity) can be closely associated (limits with odd, and unlimiteds with even).

³² Cf. Alexander, in *Met.* 74.6, where describing how the Pythagoreans gave a proper number to each region of the universe as well as to certain concepts, Alexander says that they assigned the one to the centre of the cosmos, for it was the first thing there—τῷ μὲν γὰρ μέσῳ τὸ ἓν (πρῶτον γὰρ ἑστίν ἐνταῦθα). This would seem to agree with both test. A17 and fr. 7 of Philolaus, but there are certain difficulties with Alexander's report; see Huffman, pp. 285ff.

³³ According to Huffman, the interpretation of the one as the mathematical unit seems natural only after Plato and Aristotle and has come about as follows: although Aristotle carefully notes differences between Plato and the Pythagoreans, particularly in regard to Plato's separation of mathematical from things, nonetheless in those treatises not specially devoted to the Pythagoreans he is interested in them mainly in connection to Plato and therefore 'overinterpreted the role of "the one" in light of its importance in Plato' (p. 209). Against this and Huffman's ongoing discussion in a similar vein (pp. 209ff.) I raise two elemental objections. First, while no one will deny that the Academy took the one to heights not reached in fifth-century Pythagoreanism, the construction of the number one and its role in the generation of the cosmos (Arist. *Met.* 1091a12ff.) were not Platonic inventions; the doctrine of τὸ ἓν comes from pre-Platonic Pythagoreanism (Arist. *Met.* 1053b12f., B. L. van der Waerden, 'Pythagoreer', *RE* XXIV, 1 [1963], 247). My second point has been stated well enough by Guthrie; Aristotle was 'perfectly capable of distinguishing non-Platonic Pythagoreanism from the teaching of his master' (p. 256, cf. p. 241). This is valid even if, as Huffman supposes (pp. 63f.), Aristotle wanted to bring the Pythagoreans into a debate with Plato.

III

One final hurdle needs to be cleared. This obstruction meets us when we try to reconstruct the cosmogonic process after the construction of the central fire. As there is little help forthcoming from the fragments, recourse is again taken to certain passages in Aristotle (though he raises as many problems as he answers) that describe a Pythagorean cosmogony. The mainstay is *Met.* 1091a12–22:

It is also strange, or rather impossible, to posit a generation for things that are eternal. Now there is no need to doubt whether or not the Pythagoreans posited a generation; for they say clearly that when the one had been constructed (τοῦ ἐνὸς συσταθέντος), whether from planes or surface or seed or things they are at a loss to say, immediately (εὐθὺς) the nearest part of the unlimited was drawn in (εἴλκετο) and limited by the limit. But since they are making a cosmos (κοσμοποιούσι) and wish to be understood in a physical sense (φυσικῶς), we may justly examine them about physics but dismiss them from the present inquiry; for we are seeking the principles in things unchangeable, so that it is the generation of numbers of this kind that we must consider.

Huffman is not the first to see this as a commentary on Philolaus fr. 7.³⁴ The cardinal points of connection are the construction of the one in a cosmogonic context (κοσμοποιούσι) and the absence of any definite explanation of the elements from which the one was constructed (cf. *Met.* 1080b20f., to be discussed in the epilogue). There are reservations one may have about seeing one particular Pythagorean lurking behind Aristotle's account, but his observations do appear in part to be based upon something he encountered in Philolaus.³⁵ Aristotle's description of how the nearest part of the unlimited was drawn in (εἴλκετο) and limited by the limit can be taken as a clue for how Philolaus depicted the continuation of his cosmogony. Aristotle's use of the term εἴλκετο may here intimate the Pythagorean conception of the cosmos as a breathing organism, a conception attested for the Pythagoreans by other texts that speak of the universe as breathing in the void or drawing in time, breath, and void from the unlimited.³⁶ That this holds for Philolaus as well is suggested by his embryology. In A27 the embryo is said to be hot because both the womb and the seed from which the embryo is constructed are hot, but that immediately (εὐθέως) upon birth the animal draws in cold air (πνεῦμα) from the outside and discharges it again (respiration is presented as necessary for the cooling of our bodies). In view of the microcosm-macrocosm correspondence that informs so much of Greek thought, it is legitimate to argue from analogy that in Philolaus' cosmogony the central fire (the hot), immediately upon its being fitted together, drew in breath (corresponding to the cold) or void, which can be seen as unlimiteds.

This has been the standard view of the development of Philolaus' cosmos.³⁷ Huffman, although he accepts and does much to elucidate the idea of cosmic inhalation, as suggested by Aristotle and supported by Philolaus' theory of human respiration, nonetheless rejects the traditional interpretation since it 'presupposes the identification of the one in F7 with the principle of limit which limits the void that is breathed in'. This he finds unacceptable because 'when the one is said to be fitted together in F7, this clearly means that the one in question (i.e. the central fire) is a compound of limiters and unlimiteds and cannot be identified with the limiting principle alone' (p. 205).³⁸ To be sure, the best evidence from Aristotle (*Met.*

³⁴ Huffman, pp. 62, 203f., 227, 228; cf. Frank, p. 327; Ross, ad loc. (II 484).

³⁵ Cf. n. 9 above.

³⁶ See the collection of texts by Guthrie, pp. 276f.

³⁷ Frank, pp. 327f., H. C. Baldry, 'Embryological Analogies in Pre-Socratic Cosmogony', *CQ* 26 (1932), 27–34 at 33, Guthrie, pp. 278f., Burkert, p. 37 and n. 47, Kahn, pp. 174f., Huffman, pp. 43f. For G. E. R. Lloyd, *Polarity and Analogy* (Cambridge, 1966), p. 238, n. 2, Philolaus' embryology 'roughly' parallels the cosmogonic inhalation.

³⁸ Cf. Burkert, p. 255.

986a17–21 and fr. 199) informs us that the one consists of both odd and even; as such, it corresponds to the central fire as a compound of limiters and unlimiteds, but if Philolaus identified the one, as number, with the central fire, this would equate the one with limit.

Huffman's characteristic solution is to dispense with the interpretation of the one as number. His main point is that fr. 7 is a cosmological fragment and not concerned with the generation of the number series, as is usually supposed on the basis of Aristotle. Yet Huffman does try to explain how the generation of the cosmos is tied to the generation of numbers, since he has to admit that both Aristotle and the fragments of Philolaus clearly suggest that numbers are connected with cosmogony. It is here that he refers to the Presocratic tradition in which things are spoken of as being one; he recognizes that Philolaus would have also been writing with an eye on the atomists, so that 'Philolaus postulates a plurality of existents but his basic unit is the unity of limiter and unlimited held together by a *harmonia* that is completely intelligible in so far as it can be expressed by a mathematical relationship' (pp. 208f.).³⁹ This mathematical relationship, since it is invariable, ensures the intelligibility of things (invariability being, as for the Eleatics, a prerequisite for the knowledge of things). 'Thus,' Huffman continues, 'when Philolaus calls the central fire, the first thing put together by *harmonia*, the one, he is saying that it is the paradigm case of something that truly exists, a paradigm that will be embodied again and again in the further generation of the cosmos from limiters and unlimiteds' (p. 209).

In attempting to define more narrowly the 'mathematical relationship', which he sees as the harmonization of limiters and unlimiteds to form an invariable, paradigmatic unity, Huffman cannot escape the need to talk about numbers: 'If the cosmos is to be explained in terms of number there must be correspondences between numbers and things, such as the equation of even with unlimited and odd with limiters, as well as the unification of these opposing principles in an even-odd (the unit and proportions). To be sure the relationship of correspondences and similarities remains vague, but there is no good support for Aristotle's assertion that the Pythagoreans *identified* the creation of the material world with the generation of numbers and thought of the first step in the generation of the cosmos as identical with the generation of the arithmetical unit' (p. 211, his emphasis).⁴⁰

I have quoted Huffman extensively not only to present his case fairly but also to suggest that Huffman himself creates some of the vagueness which he sees in Philolaus by his unwillingness to recognize the one as the unit. Many clouds can be dispelled if we acknowledge that it would accord with Philolaus' programme ('all known things have number') for him to introduce at the beginning of his cosmogony the number from which all other numbers arise, identified, in an appositional phrase in fr. 7 (*pace* Huffman, p. 229), with the first cosmic body from which the remaining cosmos will develop. In so doing, Philolaus intimates from the outset the close connection, indeed identification, between things and their informing numbers that will remain a permanent feature of the cosmos. And instead of seeing this continuity merely as the repeated embodiment of a paradigm, we should allow that for Philolaus the

³⁹ Here Huffman indirectly supports the point I made earlier and sought to illustrate from fr. 6, that it will not do to banish Philolaus' epistemological concerns, which apparently could be resolved by the use of number, from his discussions of the generation and composition of things.

⁴⁰ So already Cherniss, p. 39, in regard to *Met.* 1091a13–22: 'the One here mentioned need not be considered the numerical unit; it is rather the universe itself...'; in agreement, L. Ya. Zhmud', 288. But cf. Philip, p. 76; 'The number theory of the Pythagoreans derives from their cosmology and, in its principal aspects, is cosmology' (his emphasis). Sim. Burkert, p. 36: 'To the Pythagoreans, number philosophy is cosmogony.'

development of the cosmos is more strictly derivative: every unity in the cosmos, taken either as whole or in terms of the constituent parts that render it a *harmonia* (limiters and unlimiteds and their explanatory numbers),⁴¹ derives ultimately from the first unity, the central fire. This 'first thing fitted together' is made intelligible through its mathematical structure, expressed numerically by the one, just as all things to follow could be understood by the numbers deriving from the one. Moreover, since there are many unities in the cosmos (as Huffman says, 'Philolaus postulates a plurality of existents', p. 208), we have in Philolaus a clear case of 'the many' originating from 'the one', which is wholly consonant with Aristotle's testimony that the Pythagoreans derived number from the unit.⁴²

But this still leaves us with the one somehow identified with limit, since according to Aristotle immediately after its construction 'the nearest part of the unlimited was drawn in and limited by the limit'. I think, however, that the problem can be surmounted; it actually need not be a problem if the situation is considered as follows: unity when taken by itself is indeed a compound of limit and unlimited, of odd and even, but when in the formation of the cosmos it is brought into conjunction with other elements it acts as a limiting principle.⁴³ This seems to be exactly what is required in regard to the central fire. Consider how Huffman describes the continuation of Philolaus' cosmogony after the construction of the central fire: 'Then the primeval ball of fire attracts breath and other unlimiteds (e.g. time and the void) from the surrounding unlimited and these are *combined with limiters* to produce the

⁴¹ It is not clear whether the odd and even forms of number were applied respectively to limited and unlimited things or just certain whole numbers to various unities; it is clear only that all known things have number and that the central fire had the number one.

⁴² Cf. Stokes, p. 247: 'If, as Aristotle says (*Metaphysics* 986a19), there was a school of Pythagorean thought holding the unit to be a compound of Limit and Unlimited, then at least these same thinkers believed that number came from the unit, τὸν δ' ἀριθμὸν ἐκ τοῦ ἐνός. In so believing they were obviously ignoring the veto—if there ever was a veto—on a "one" producing a "many." A clearer case of derivation of a plurality from a unity it would be hard to find.'

⁴³ This double status of the one may explain why in another Pythagorean text, the table of opposites (*Met.* 986a22), it appears with the odd as a manifestation of limit. I do not mean hereby to revive older theories about a chronological development in Pythagoreanism from an older teaching of the one as odd to a newer, post-Parmenidean version of the even-odd, nor to posit different schools of thought within contemporaneous Pythagoreans. On all this see Stokes, pp. 244ff., who himself doubts 'whether the Table of Opposites implies a different view of "one" from the usual even-odd designation' (p. 246). It is my belief that the Pythagoreans could view the one as essentially a unity of odd/limit and even/unlimited and, without causing themselves much headache, treat it as odd and assign it a limiting function when required (not much is gained by following Stenzel, p. 6, who ascribes to the Pythagoreans 'neben der Eins ein anderes einheitliches Prinzip, das Unbegrenzte').

This appears to be the case not only in Philolaus' cosmogony but also in Pythagorean pebble arithmetic (see Arist. *Phys.* 203a13; thereto, Guthrie, p. 243 and Burkert, p. 33, n. 27) and musical theory—in the ratio of the octave, 2:1. Huffman, in his discussion of Philolaus' fragment on harmonics (pp. 149ff., 161f.), does well to try to clarify the terms by which the octave is designated (διὰ πᾶσαν as the concord and *harmonia* as covering the scale, 'an attunement an octave long'), but he does not convince me that earlier scholars (Boeckh and Frank; see Huffman, pp. 159f.) were wholly wrong in identifying the principle of limit with the 1 in the octave and the unlimited with the 2 (for which the 'indefinite dyad' is of course a later Platonic term). One should not lose sight of the forest for the trees and forget the essential Pythagorean discovery (whatever its empirical bases) of simple numerical ratios to express harmonic intervals, which 'made it appear that *kosmos*—order and beauty—was imposed on the chaotic range of sound by means of the first four integers 1, 2, 3, 4' (Guthrie, p. 224). However Philolaus conceived of the 'size of *harmonia*' (fr. 6a init.), he was primarily interested in the whole numbers of the ratios (pace Huffman, p. 160; cf. n. 25 above), numbers that corresponded to limiting and unlimited principles.

famous Pythagorean cosmos described in the *De caelo* (p. 211, my emphasis). There is no lack of unlimiteds (breath, time, void), but what, one may ask, are the limiters with which they combine at this stage? I think Huffman himself points the way when, in order to ally Philolaus with the Milesian cosmologists, he pursues the respiration analogy and says that this next stage 'involves interaction between fire and breath' (p. 214). Although we can only speculate on how fire acts upon the breath from the unlimited, it is at any rate clear that fire must be the limiting principle in this interaction.⁴⁴ If then the central fire, itself a harmony of limiters and unlimiteds, has initially a limiting function in the cosmogonic process, it follows that the one which describes this first unity also has this function, even though, considered by itself, it is a compound (of even and odd, unlimited and limit).⁴⁵ The first unity, described as the hearth of the universe and the one, is the source for all the order and structure that finally make of the whole cosmos a unity; the beginning is fire and number.⁴⁶

IV

I should like to add a brief *plaidoyer* for fragment 8 (= Iambl., in *Nic.* 77.8). Here Iamblichus lets fall the remark that Philolaus said the one is the principle or source of all things (ἀρχὰ πάντων).⁴⁷ Huffman considers this fragment spurious not only

⁴⁴ It is noteworthy that fire and limit seem to be (spatially) associated in Aristotle's account of why certain thinkers, in agreement with the Pythagoreans, make fire central: 'They think that the most honoured place properly belongs to the most honoured thing, and that fire is more honourable than earth, and limit more honourable than what lies in between, and that the outermost boundary and the centre are a limit' (*de Caelo* 293a30). That the priority of fire over earth (or other elements) obtains for Philolaus is suggested by his embryology, in which the hot as the original vital element of the body can be compared to the central fire; and the association of fire with limit fits his system as well, not only because he assigned a limiting action to the central fire but also because, according to test. A16, he located 'another fire' at the uppermost boundary surrounding the spherical universe; cf. Huffman, pp. 244ff. A further link between fire and limit may again be sought in Philolaus' embryology. Since Huffman is inclined to believe that the hot, at least at the embryonic stage, is the sole element of the body (in effect, a monistic theory of the body's composition, see p. 294), he allows me to make this, albeit tentative, parallel. The body is originally a 'one', in the sense of being solely constituted of the hot; it then draws in the cold air from outside and emits it again, thus starting the process of respiration (which is vital for cooling the body). If in this process the external air may be seen as the unlimited element, the hot is somehow the limiting element (but cf. Huffman, pp. 45f.), perhaps in the measured intake and discharge of the cold air in breathing. Similarly the central fire, the one, takes on a limiting function by drawing in breath (and void and time) from the unlimited, thereby initiating the further development of the cosmos.

⁴⁵ Cf. Boeckh, p. 95, who sees the central fire as 'die Einheit... in welcher die Welt ihren Halt hat, und welche zugleich als die Einheit Allem das Maß und die Begrenzung giebt.' I differ from Boeckh, however, in that he does not recognize the dual aspect of the one and treats it solely and consistently as a limiting principle (pp. 54ff.); cf. Nussbaum, 97, n. 85. It is precisely the interplay of 'duality and singleness', of unlimited and limited, represented *in nuce* in the one, that makes up the all-pervading *harmonia* of the cosmos. As Walter Burkert observes (in a letter dated 5.3.94): 'Die Frage, warum das "Eine", obschon aus Begrenztem und Unbegrenztem bestehend, gegenüber dem unbegrenzten "Hauch" dann *de facto* als Grenze wirkt, könnte man vielleicht auch von seinem Charakter als *Harmonia* herleiten: Eben als solche muß es "gegensteuern", bis das große Unbegrenzte seine weitgespannte Grenze in der Kugel des Himmels erhält, so daß dann mit dem "Zwei" gegen "Eines" die "durch alles hindurchgehende" *Harmonia*, διὰ πασών, 2:1 [fr. 6a], gesichert ist.'

⁴⁶ The one is thus more than a paradigm, since the numbers that could apparently render the order and structure of physical bodies intelligible derive from the one.

⁴⁷ The manner in which Iamblichus refers to Philolaus is noteworthy: ἡ μὲν μονὰς ὡς ἂν ἀρχὴ οὐσα πάντων κατὰ τὸν Φιλόλαον (οὐ γὰρ ἔν φησιν ἀρχὰ πάντων);... Iamblichus characterizes the monad in a participial clause 'in so far as it is' (or: 'would be'—note ἂν) 'the principle of

because it reflects a Neoplatonic understanding of the one as a transcendent unity but also because it is inconsistent with fragment 7, in which the one is something fitted together; hence 'it is hard to see how Philolaus could call it the first principle of *all* things, especially since he calls the elements from which it is put together, limiters and unlimiteds, first principles (*ἀρχαί*) in F6' (p. 346, his emphasis).⁴⁸ It seems to me, on the other hand, that Philolaus could quite easily have regarded the one as a principle or source without supplanting the principles of limiters and unlimiteds which are after all incorporated in the one. Certainly limiters and unlimiteds are in a sense more basic principles, in so far as they are said in fr. 6 to be the pre-existing *ἀρχαί*, but once they are harmonized to produce the central fire, this 'first thing fitted together' becomes the source for everything else in the cosmos. In the actual development of the cosmos the one is undeniably the starting-point, the source of all things as well as of the numbers identified with them and that make things intelligible.⁴⁹ Even if Philolaus did not call the one an *ἀρχή*, it is still not a far-fetched interpretation on the part of Iamblichus.

EPILOGUE

As a rule people do not confuse physical with mathematical beings, yet the history of philosophy from Pythagoras to Russell shows the power of the temptation to think of each kind of being in terms appropriate to the other...⁵⁰

If a reasonable case has been made that Philolaus put a physical body, the central fire, on equal footing with a number, the one, we have added grounds for believing that the Pythagoreans identified things with numbers in the way that Aristotle says they did. And that the Pythagoreans equated physical substances with mathematical in a quite literal fashion is clear from Aristotle's response: 'The [Pythagorean] statement that bodies are composed of numbers, and that this refers to mathematical number, is impossible' (*Met.* 1083b11–13). Aristotle's exasperation cannot be explained as the fruit of his own devices; his criticism of the Pythagoreans did not arise from his own interpretation of Pythagorean doctrine, from what he thought that doctrine 'amounted to' (as Huffman would have us believe), but from the actual claims of the

all things according to Philolaus' and asks parenthetically, 'for does he not say [the] one is principle of all things?' (punctuated as a question after Boeckh, p. 150). The parenthesis looks as if it were Iamblichus' way of seeking to confirm what he has just ascribed to Philolaus and thus has a ring of authenticity. (According to test. A10 = Theo Sm. 20.19, Archytas and Philolaus referred indiscriminately to the one and the monad. Since it is probable that Philolaus only spoke of the one, as in fr. 7 and perhaps as here in Iamblichus' parenthesis, and not of a monad, Theon's testimony is best taken to mean that Philolaus did not distinguish between the one and the monad in the Platonic fashion; cf. Huffman, p. 340.) Iamblichus, I might add, is not an inherently unreliable witness, though of course he often needs to be shorn of his Neoplatonic trappings. In *Nic.* 7.8 = fr. 3 appears to be a genuine nugget (accepted as authentic by Huffman, pp. 113ff.) whereas in *Nic.* 10.22 = fr. 23 consists wholly of later interpretation (Huffman, pp. 354f.) and allows us at most to infer that number played an important role in Philolaus' cosmology.

⁴⁸ Huffman brings the same objections against Syrianus, in *Met.* 165.33 (= fr. 8a). Syrianus posits for Philolaus a god who established limit and unlimited and a transcendent unitary cause. Though this is patently Platonic, we should not be too quick to assume that his concluding assertion about the one in Philolaus, *Φιλόλαος δὲ τῶν πάντων ἀρχὴν εἶναι δι᾽ ὅσυχριζεται*..., is also erroneous, even if he is merely echoing Iamblichus.

⁴⁹ Cf. Zeller-Nestle, p. 478: 'Philolaos nennt zwar das Eins den Anfang von allem, aber damit will er schwerlich etwas anderes ausdrücken, als was auch Aristoteles sagt, daß die Zahl Eins die Wurzel aller Zahlen und somit, da alles aus Zahlen besteht, auch der Grund aller Dinge sei.'

⁵⁰ H. Nielsen in *The Concept of Matter in Greek and Medieval Philosophy*, ed. E. McMullin (Notre Dame, 1963), p. 255.

Pythagoreans which we may rightly suspect he knew better than we.⁵¹ As Guthrie has remarked with eminent good sense: 'Their accounts did not satisfy him, but he is not likely to have invented those that he mentions and dismisses' (p. 277). If the Pythagoreans had only spoken of odd and even numbers, of the one as odd-even, of odds producing squares, of evens producing oblongs, etc., in other words, had confined themselves to assertions about number and simple geometrical observations deriving from pebble arithmetic, Aristotle would never have taken offence at them (and probably never have regarded them). What brought the Pythagoreans to Aristotle's attention is precisely their application of number to the cosmos, and it is for the conflation of mathematical with cosmological bodies that he also dismisses them: 'since they are making a cosmos and wish to be understood in a physical sense, we may justly examine them about physics but dismiss them from the present inquiry' (*Met.* 1091a18–20).⁵²

But if we forfeit the convenient but hardly defensible argument that Aristotle misunderstood the Pythagoreans, we must confront the inherent problem of how on earth to understand the Pythagorean identification of things and numbers. Ultimately, of course, Aristotle is right: that bodies are composed of mathematical numbers is impossible. Things are patently not numbers. Yet it is possible, thanks to Aristotle's reports about the Pythagoreans, to gain some understanding of the thought processes involved in imagining that things are made up of numbers. A crucial text is *Met.* 1080b16–20:

The Pythagoreans...posit one kind of number—the mathematical, though not as existing separately [i.e. as the Platonists believed], but they say that sensible substances are composed of it; for they construct the whole universe out of numbers, though not monadic numbers [i.e. unextended and incorporeal], but they suppose the units to have magnitude.

Aristotle tells us that the Pythagoreans considered numbers to be units possessed of magnitude (*τὰς μονάδας ἔχειν μέγεθος*). In the continuation of the same passage he appends a telling criticism: 'But as to how the first one (*τὸ πρῶτον ἓν*) came to have magnitude they appear at a loss to say' (20–1). We have already seen (III above) Aristotle ascribe to the Pythagoreans a similar *aporia* in regard to the construction of the cosmogonic one ('whether from planes or surface or seed or things they are at a loss to say'). Taken together, Aristotle's criticisms suit Philolaus particularly well, for even if Philolaus specified that 'the first thing fitted together, the one' was a product of limiters and unlimiteds (the odd and even elements of number), this still begs the question of how the one, being a number, should have size so as to constitute a cosmic body. Nonetheless, in the Pythagorean view a solid body is an aggregate of units, and, since units are equal to numbers, a body is composed of numbers.⁵³ That this is the

⁵¹ This would certainly be borne out if we still had Aristotle's lost work on the Pythagoreans; thereto, see Guthrie, p. 215, n. 1.

⁵² The larger context of the passage is quoted above (III init.). As Aristotle's inquiry has to do with unchangeable and immovable principles, he cannot accept the Pythagorean ascription of a physical generation to numbers if numbers are to be understood as eternal. But the Pythagoreans, as we will see, failed to conceive of numbers as abstract mathematical principles. Hence it is not the case that 'Aristotle is confusing... the cosmogony with the number theory', as Cherniss says (p. 39; cf. n. 40 above). Aristotle wanted to keep mathematical and physical cosmology in separate categories; the confusion of the two rests squarely with the Pythagoreans.

⁵³ Somewhat analogous to the way the atomists thought of bodies as consisting of invisible atomic units; but even though Aristotle mentions the Pythagoreans in conjunction with the atomists (*Met.* 985b23) there are important differences between the two (mainly, the indefinite number of atoms supposed by the atomists to constitute bodies as opposed to the limited amount of numbers that sufficed for the Pythagoreans to account for a thing), so that one should not interpret the Pythagorean doctrine as a kind of 'number atomism'; see Burkert, pp. 41f.

way the Pythagoreans viewed physical substances seems confirmed not only by Philolaus' designation of the central fire as τὸ ἐν, but also by the curious practice of his pupil, Eurytus, who would determine the number of a man, for example, by affixing to a drawn sketch of a man some pebbles 'equal in number to the units (ταῖς μονάσιν) which he said defined (ὀρίζεω) man'.⁵⁴

Where precisely lies the confusion? Again, Aristotle is of help. In his discussion of time in the *Physics*, where he establishes that time is a kind of number in so far as it is measurable or countable motion, he explains parenthetically that number has two senses: 'both of that which is counted or the countable and also of that with which we count' (219b5f.). Now the Pythagoreans, as Aristotle tells us in *Met.* 1080b16ff. and elsewhere, knew of number only in the first sense, as a number of certain things, but not as existing separately (κεχωρισμένον). In other words, the Pythagoreans failed to distinguish between that which can be counted, the things that 'have number', i.e. count, and that by which we count, the numbers themselves. To speak of numbers 'themselves' entails a mental separation of that by which we count from that which is counted—a feat of abstraction that is not in evidence among the Pythagoreans. Here scholars have rightly pointed to the pre-Platonic setting of Pythagorean thought in which the distinction between the corporeal and the incorporeal, the concrete and the abstract, had not yet been clearly articulated.⁵⁵ To emphasize that the Pythagoreans were Presocratics is not to belittle their accomplishments. Indeed, it is only by comparison with their Presocratic predecessors and contemporaries that a true measure of their achievement can be taken. When the Pythagoreans speak of numbers and not, say, air or fire, as somehow accounting for the nature, the φύσις, of the world, we along with Aristotle prick up our ears. The Pythagoreans were on to something. The discovery, as Huffman has demonstrated well in the case of Philolaus, was of an epistemological kind: things have a structure that could be described mathematically, or, put the other way round, numbers enable us to know things. But at this point we need to be careful not to attribute to the Pythagoreans *our* rather sophisticated means of explaining the epistemological relationship between things and numbers. Thus, when following Huffman's lead we have spoken of the 'correspondence' of limiting and unlimited things with the odd and even elements of number, or said that cosmic bodies have numerical 'counterparts', or granted that the one may be seen as a 'symbol' of unity, it is important to remember that the terms here put in quotation marks are ours and not the Pythagoreans'. Moreover, these descriptions are misleading in so far as they suggest a parallelism between things and numbers, whereas for the Pythagoreans the two lines of the parallel are intertwined. That by which we know is fused with that which is known; the symbol is made one with that which it stands for; the number that best represents the mathematical structure of Philolaus' central fire is actually equated with it. This is not to say that one cannot find certain expressions in the Pythagorean fragments that intimate an incipient notion of the purely symbolic value of number, but that notion is never pursued to the extent that the signifying number is clearly distinguished from the thing signified.⁵⁶ The Pythagoreans, as Aristotle

⁵⁴ Ps.-Alexander, *Met.* 827.9 (DK 45A3), elaborating on Arist. *Met.* 1092b8ff. Theophrastus, *Met.* 6a19ff., gives Archytas as the source of the story. On Eurytus' practice, see further Guthrie, pp. 273ff., Barnes, pp. 390f.

⁵⁵ Cf. Guthrie, pp. 237f., Burkert, p. 46, Ross, *ad Met.* 1080b19 (II 428–9).

⁵⁶ As far as I can see, the closest Philolaus comes to anticipating a symbolic use of number is when he says, in fr. 5, that each thing signifies (σημαίνει) the many forms (μορφαί) of number. This allows us to say, in regard to fr. 7, that the central fire is the one thing that signifies the form of the one, yet it still appears, from our examination of fr. 7, that Philolaus identified the first

notes (*Met.* 985b27ff.), may have started off by seeing 'resemblances' (ὁμοιώματα) between things and numbers, but again mere similarity is swallowed up in identity so that 'they supposed the elements of numbers to be the elements of all things'. In the end they make a cosmos (κοσμοποιούσιν) out of numbers. It is precisely this welding of physical cosmology with mathematical that so annoyed Aristotle. Certainly, from our perspective, the Pythagorean concentration on the numerical, formal elements of things and not only on their matter is a milestone in Presocratic thought and may even be seen as anticipating the leap into the abstract that we find in Plato and Aristotle. In the final analysis, however, the Pythagoreans remain on the Presocratic side of the fence. In common with the Presocratics they examined the *physis* of the world and came up with defining principles which we recognize as expressions of the formal characteristics of things and not on a level with the material principles of the other Presocratics but which the Pythagoreans themselves, still largely bound by the tradition of the Presocratic *physiologoi*, could only conceive of as being the very substance of things.⁵⁷ As Aristotle reminds us, when he takes the Pythagoreans to task for confusing material and formal causation, 'Evidently these thinkers consider number to be a principle (ἀρχή) both as matter (ύλη) for existing things and as forming their modifications and permanent conditions ...' (*Met.* 986a15–17).⁵⁸ The language is undoubtedly Aristotle's but it is a fair indication that the Pythagoreans could no more think of number as immaterial and non-spatial than the Ionians could of the four elements.

It is not easy to comprehend the mind-set of Presocratic thinkers. The Pythagorean identification of things and numbers in particular remains a problem that entails a number of puzzles, but it is a problem the study of which can be enlightening for our understanding of Presocratic thinking. The proviso is that we meet the Pythagoreans on their own turf, resisting the temptation to make them more sophisticated than they were by bringing them closer to our way of thinking and expressing our thoughts. We need not call them primitive; a kinder term would be 'other'. The Pythagoreans, including such a later Pythagorean as Philolaus, are yet on the other side of the dividing line that is made up of Platonic dialectics and Aristotelian categories and distinctions to which we are heir. But if we try to argue that Aristotle had it all wrong about the Pythagoreans and thus try to explain away the confusion inherent in the Pythagorean number doctrine, we run the danger of explaining away an important stage in the history of Greek philosophy.

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cosmic body with the number signified by it. Even Huffman, who insists on maintaining a strict parallelism between things and numbers in Philolaus, admits, on the basis of Aristotle's evidence, that 'the Pythagoreans ... do not think of the numbers that are pointed to as separate from the things which do the pointing, but rather as in some way part of them' (p. 193).

⁵⁷ Cf. Aristotle, *Met.* 989b33ff., chiding the Pythagoreans for using their discovery of non-sensible, immovable mathematical as supplying the principles for the physical world: 'their discussions and concerns are yet all about nature (περὶ φύσεως), for they generate the heaven, and they observe what happens in regard to its parts, and attributes, and functions, and use up the principles and the causes for these studies, as though they agreed with the physical philosophers that only that is real which is perceptible and contained by the so-called heaven.' Huffman, while he admits that Aristotle's words here find an exact target in Philolaus, whose 'thinking is still very much in the Presocratic mode' (p. 52), nonetheless does not allow Aristotle's essential criticism of the Pythagorean confusion between mathematical and substances to apply to Philolaus.

⁵⁸ Ross comments ad loc. (II 147), 'We are not to suppose that they deliberately rejected the notion that numbers are not spatial. Like all the pre-Socratics, they had not reached the notion of non-spatial reality.'