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The Indivisibility of the Atom

by Stephen Makin (Sheffield)

"What are the simple constituent parts of a chair? — The bits of wood of which it is made? Or the molecules or the atoms? — "Simple" means: not composite. And here the point is: in what sense "composite"? It makes no sense at all to speak absolutely of the 'simple parts of a chair'." Wittgenstein, *Philosophical Investigations*, par. 47.

I will state the argument which, I hold, grounds the indivisibility of the Democritean atom. I will not, in this paper, discuss the textual arguments which show this argument to have been Democritean.¹ My purpose in this paper is to discuss what we should say about the indivisibility of the atom, assuming that the argument I give provides the Democritean account of atomic indivisibility. I hope also that the account offered provides a new approach to the discussion of atomic indivisibility.

The argument offered by the Atomists for the existence of atoms is of the "everywhere alike" (παντῇ ὁμοίον) form.² This argument is closely connected with arguments of the same form used, to a different end, by the Eleatics. This is as we might expect, if the Atomists are reacting to certain conclusions of Eleatic argument (that what there is is indivisible and one) applied to the whole of what there is, but are drawing similar conclusions applied to components of what there is (that what there is is made up of bits which are each indivisible and one). Use of this argument is reported by Aristotle in *De Generatione et Corruptione*

¹ I discuss the use of this argument form by the Eleatics in my "Zeno On Plurality," *Phronesis* 1982. I do not, in this paper, establish that the Democritean account of the indivisibility of the atom is based on the argument form I outline in the paper. To establish that convincingly would require making a long paper considerably longer. For it would be necessary to consider at length the reports by Aristotle at GC 1.2.8. I discuss those Aristotelian texts in a separate paper currently in preparation.

² For uses of the phrase παντῇ ὁμοίον in the Eleatics, see Simplicius in *Phys.* 139.27–140.6; this passage is discussed in the paper cited in note 1 above. Reference to the Greek commentators is to the page and line number of the *Commentaria in Aristotelem Graeca* edition.

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1.8. Any atom is homogeneous (GC 1.8 325a28 f.). If then it were divisible anywhere, it would be divisible everywhere.³ Homogeneity rules out the finite divisibility of what is homogeneous, since finite divisibility would be divisibility just up to a certain stage, and then the question arises why up to that stage and no further? Clearly no nonarbitrary answer can be given. Since what we are dealing with is homogeneous, there could be no differences in its structure to account for this finitude of division.⁴ If finite divisibility is ruled out for a homogeneous body, then only two alternatives remain: indivisibility or divisibility everywhere. But divisibility everywhere is held to lead to contradiction.⁵

It follows then that any homogeneous body is indivisible. Now the Eleatics hold that the whole of what there is is homogeneous, for there is nothing other than being which could provide distinctions within being.⁶ The Atomists see that the Eleatic conclusion will not do.⁷ At GC 1.8 the Eleatics are said to follow the argument, and to ignore the evidence of sense (GC 1.8 325a13 ff.). They are criticised for the lunacy of this (GC 1.8 325a18–22), while the Atomists' theory is presented as in harmony with the evidence of sense (GC 1.8 325a31). If the homogeneity of all that there is would lead to its indivisibility, and yet it is plain from sense that there is some plurality of what there is, then it must follow that what there is is not homogeneous. Hence the Atomists introduce the void, and thus distinctions within the whole of what there is. There is void (GC 1.8 325a31), and something is divisible insofar as, and to the extent that, there is void in it.⁸ It follows then that what contains no void is indivisible. The atom contains no void (GC 1.8 325a25), and thus we have an argument by which the atom is shown to be indivisible. In summary: if an atom is somewhere divisible it is everywhere divisible; since it is not possible that it be everywhere divisible, it is nowhere divisible (i.e. indivisible).

Let it be accepted that this argument grounds the indivisibility of the Democritean atom. The atom is indivisible because it is solid

³ The point is put at GC 1.8 325a9–12 in connection with the Eleatics.

⁴ This argument is of a more general form, known as οὐ μᾶλλον arguments, after the Greek phrase meaning "no more-than". On those arguments see my paper, "Buridan's Ass," *Ratio* 1986.

⁵ See Aristotle's summary at GC 1.8 325a8 f. in connection with the Eleatics. Compare also GC 1.2 316a5 ff.

⁶ See Parmenides, DK 28 B 8.22, 25.

⁷ Note the use of φανερόν (plain, obvious) at GC 1.2 316b29.

⁸ Simplicius, in *De Caelo* 242.20 on = DK 67 A 14.

(homogeneous).⁹ I now want to consider whether this account of atomic indivisibility is profitably dealt with in the terms typically used in discussion of atomic indivisibility.

As soon as any account of atomic indivisibility is offered, the temptation is to characterize it as one of the two alternatives commonly allowed¹⁰ — physical indivisibility or theoretical indivisibility.¹¹ I will argue that in fact nothing is put clearly in these terms, and this way of approaching the matter should be abandoned. By this I do not mean simply that Democritus did not draw a distinction between physical and theoretical indivisibility,¹² though it will follow from what I argue that there is no such distinction to be found in Democritus. I mean further that there is no sensible distinction to be made between physical and theoretical (in)divisibility, so that there could be no sense in commentators' importing these terms as exegetical tools.

Now it is clear enough what account I have offered of the indivisibility of the atom: the atom is indivisible because it is solid¹³ but whether

⁹ Compare the passages cited by Luria pars. 220–235. Especially the analogy suggested by Aristotle *De Caelo* 1.7, 275b30 on: as if each atom were in separation gold.

¹⁰ See, for example, Furley, *Two Studies in the Greek Atomists* (Princeton University Press, Princeton/New Jersey, 1967), Study I; Stokes, *One and Many in Presocratic Philosophy* (Centre for Hellenic Studies, Washington DC, 1971), pp. 225 on; Sorabji, "Atoms and Time Atoms," in *Infinity and Continuity in Ancient and Medieval Thought*, ed. N. Kretzmann (Cornell University Press, Ithaca and London, 1982), gives the question and summarizes a list of opinions. This work has now been reworked and expanded in Sorabji, *Time, Creation and the Continuum* (Cornell University Press, Ithaca and New York, 1983) — see p. 354, note 18.

¹¹ As Furley. "Conceptual indivisibility" is sometimes put instead of "theoretical indivisibility."

¹² This interesting line has recently been argued for by Sorabji, *op. cit.*, pp. 354–357 and "Atoms and Time Atoms," *op. cit.*, pp. 44f. Leucippus and Democritus did not, he argues, distinguish between physical and theoretical (conceptual) indivisibility. Epicurus did later, and commentators read his distinction back into the early Atomists. This account fits well with Sorabji's view, expressed in his "Aristotle and Oxford Philosophy," *American Philosophical Quarterly* 6 (1969), pp. 127–135, that Aristotle did not distinguish between logical and non-logical necessities. It explains also the clash in the doxographical evidence on the indivisibility of the atom.

¹³ Besides the solidity of the atom there is its hardness. These are distinguished in the doxography. E.g. it is not simply repetition when Simplicius writes, *Luria* par. 212: ... ἡ τῶ μῶρια ἔχειν καὶ μέγεθος, ἀπασθῆς δὲ εἶναι διὰ στερεότητος καὶ ναστοτήτος, καθάπερ ἐκάστη τῶν Δημοκρίτου ἀτόμων. Now hardness and solidity are distinct properties. The former is the capacity to retain shape under pressure the latter is the absence of internal gaps. Yet Democritus would have grounds

that is "physical" or "theoretical" indivisibility is unclear.¹⁴ An atom is shown to be indivisible by argument. Take a particular atom. Democritus' view is that *absurdities* follow from supposing it to be divided. If it is divided at any point, then, since it is solid and homogeneous, it can be divided at every point — but that is taken to give rise to absurdities. So it is necessary on the basis of *argument* that the atom be indivisible, and that might lead someone to call it "theoretically indivisible".¹⁵ On the other hand, there is no reason to think that a finitist geometry goes along with this argument, or that the atom is a partless body, and since atomic solidity gives rise to atomic hardness someone might be led to call the atom "physically indivisible". But the unclarity here is not over the way in which the atom is indivisible, but over what physical and theoretical indivisibility are intended to be.

I shall start by looking at how the distinction of physical and theoretical indivisibility is treated by an influential contemporary writer, David Furley. In view of his influence it is unfortunate that Furley does not make the distinction at all clear. Furley sets out his terms at the start of his work. Two kinds of division are to be distinguished. First physical division:¹⁶ "the division of something in such a way that formerly contiguous parts are separated from each other by

for holding that a solid atom is a hard atom too. The link of atomic hardness and atomic solidity is built on Democritus' principle that there is just one type of atomic stuff, referred to at fn. 9 above. Since the void offers no resistance to intrusion, nothing on the macroscopic level can be any harder than the single stuff of which the atoms are formed. Therefore any strength or hardness on the macroscopic level must be due to the hardness of the atomic stuff. But it is plain that some things on the macroscopic level are extremely hard. So the atom must be at least that hard. Since the void offers *no* resistance, and anything perceptible contains some void, it is plausible to suppose that it is the presence of void that is the source of weakness or softness on the macroscopic level. Theophrastus *De Sens.* par. 62 confirms that Democritus did draw this conclusion. In that case the atom would be far harder than any stuff on the macroscopic level.

¹⁴ Note that Sorabji talks of solidity as evidence of *physical* indivisibility, *op. cit.*, p. 355: "A second consideration suggesting physical indivisibility is that many passages give us Democritus' reasons for the indivisibility of the atoms their solidity (συστοτῆς, στερεοτῆς, *soliditas*) and the absence of void within them, and these sound like physical reasons."

¹⁵ I would thus disagree with Barnes' remark that with the case of solidity "we have here a physical, not a metaphysical hypothesis ... solidity does not logically imply indivisibility; but the physical process of division requires a porous body to work upon." *The Presocratic Philosophers* (Routledge and Kegan Paul, London, 1979), Vol. 2, p. 47.

¹⁶ Furley, *op. cit.*, p. 4.

a spatial interval." Second, theoretical division, which is defined in terms of a modal notion:¹⁷ "an object is *theoretically divisible* if parts can be distinguished within it by the mind, even if the parts can never be separated from each other by a spatial interval." Presumably a theoretical division is a distinction, within what is divided, of parts by the mind. But what such a distinction of parts *is*, and how one goes about distinguishing parts within something is unclear. The terminology becomes more opaque when "theoretical indivisibles" are compared with "units within which no distinctions are conceivable at all". For: "A unit which is theoretically indivisible ... may still have extremities which can be *conceived* in distinction from the unit itself".¹⁸ Then Furley seems to have this account: there are two types of *division*, the theoretical and the physical — and the theoretically indivisible is what cannot be theoretically divided.

One reason for Furley's approach is that it fits well with Epicurus' later developments of atomism. Epicurus did distinguish between the *atom*, which was in one way indivisible, and its *minimum parts* which were indivisible also in another way.¹⁹ The minimum part was something like a minimum sensible: a minimum conceivable, that than which, in virtue of its smallness, nothing smaller can be conceived. The following would, then, be a reasonable historical question to ask: was the Democritean atom indivisible in the way that only the Epicurean minimum part was, or in the way that the Epicurean atom also was?²⁰

That question would not, however, cast any light on what is being interpreted, unless the sense in which the Epicurean minimum part was indivisible was clear. It is not sufficient to note that *Epicurus* relied on an analogy between the mind and sense perception, for if the analogy is carrying the weight of explanation of the notion of theoretical indivisibility the analogy has to make some sense to us. Notice, for example, how a reliance on the Epicurean analogy renders Furley's account of the indivisibility of the atom extremely unclear at the very point where it begins to look interesting. A quotation from Furley makes this plain:²¹

What could be the reasoning behind the assertion that smallness is a cause of indivisibility? Simplicius ties smallness to partlessness ... The most likely line of argument, then, is the one used by Epicurus ... from the analogy with perception. There is a minimum perceptible quantity within which no parts can be distinguished by a perceiver. The mind's eye, as it were, functions as a microscope: it can distinguish much smaller parts than the senses can, but there is still a lower limit beyond which it cannot make any distinctions ... Since Democritus appears

¹⁷ *Ibid.*, my emphasis.

¹⁸ *Ibid.*, pp. 95 f.

¹⁹ See Epicurus, *Letter to Herodotus*, pars. 57 – 59.

²⁰ Compare Sorabji, *op. cit.*, p. 348.

²¹ Furley, *op. cit.*, pp. 95 f.

to have drawn a general analogy between sense perception and thought, and since the concept of something too small to be seen was certainly familiar to him, it seems quite likely that he might have used the idea of something so small that no parts can be distinguished even by the mind.

If it is this analogy which explicates the way in which the atom is indivisible for Democritus, then I for one just have no clear understanding of what such a notion of indivisibility is. If I do not understand the notion of indivisibility involved, then I am not able to assess the claim that Democritus held the atom to be indivisible in that sense. For the same question will always arise for me in my consideration of Democritus: *what* notion of indivisibility is meant? Since Democritus did not himself use the language and concepts that we are using to interpret his theories, it follows that the concepts have to be clear if we are to make any profitable exegetical use of them. My argument in this paper is that since the notion of theoretical indivisibility is *not* a clear notion, the question “physically or theoretically indivisible?” should be dropped.

Now of course there are distinctions that can be drawn concerning indivisibility. Something is indivisible if it is not possible that it be divided. Clearly there are different types of impossibility. For example, it is impossible (i.e. not permitted) to run across Buckingham Palace lawn, it is impossible to run faster than 90 mph, it is impossible to run faster than the speed of light. Equally there are different types of division.²² For example, a physical separation of parts, as when I saw up a plank; or a mathematical division, as when I bisect an angle in a geometrical problem; or the division of a point by lines leaving it in different directions, where the point represents the focus of forces and the lines the directions in which the forces act; or the division of the colour orange into the colours red and yellow; or the division of a colour into hue, saturation and brightness. To say of some object that it is indivisible means something different depending on how the modality is understood and what notion of division is in play.

Consider, then, the way in which modalities and notions of division are specified. It precisely depends on the *theory* against the background of which an assertion of divisibility or indivisibility is being made, although in some cases “theory” may seem a somewhat grandiose term to use. The point here can be illustrated by consideration of a specific question: “Is it theoretically impossible for a man to run at 100 mph?” The obvious and correct response to this question is that it depends on the theory one has in mind. Given the theoretical background of anatomy, it *is* theoretically impossible, unlike, for example, the

²² This is precisely the point made by Wittgenstein in the passage from *Philosophical Investigations*, par. 47, with which this paper opens.

impossibility of *my* running at even 15 mph given the same theoretical background. Alternatively, given the theoretical background of physics, it is not theoretically impossible that a man should run at 100 mph, unlike, for example, the impossibility of a man's running faster than the speed of light, given the same background.

This example shows something of the role of the term "theoretical" in the phrase "theoretical indivisibility". The term "theoretical" is a place holder, with no content of its own. It makes no sense to talk of theoretical indivisibility simpliciter, unless some specific theory gives a content to "theoretical". Much the same point applies with respect to the term "indivisible". It makes no sense to talk of the indivisible simpliciter, unless a particular notion of division is in play. What is theoretically indivisible could only be taken as what cannot, by the lights of some theory or other, be divided. Thus theoretical indivisibility will be a wider concept than physical indivisibility. A diamond is physically indivisible to me, since I am not physically capable of dividing one, and what it is physically impossible for a man to divide is what is in one way theoretically impossible to divide — namely, what it is impossible by the lights of some theory of human strength to divide. So theoretical indivisibility is a cover-all concept. There is no sense in supposing there to be some privileged sense of indivisibility, which would be what is indivisible by some privileged theory.

Consider the example of the geometrical point. That is indeed theoretically indivisible: i.e. it is impossible by the lights of Euclidean geometry to divide it, given that Euclidean geometry specifies *both* what is to count as a division (a separation into parts of smaller magnitude) *and* that the point is without magnitude. But the point is not indivisible in any privileged or especially strong sense. There could be sense to a theory according to which the point *was* divisible, if, for example, it is taken as divided by lines leaving it in different directions, the point representing the focus of forces and the lines the directions in which forces act. It would be senseless to speak of the point as theoretically indivisible simpliciter. That could at best mean what is not by the lights of *any* theory divisible. The question then would be why we should suppose that there could be any such thing.

There is an important general point here about indivisibility. Something is indivisible if it is impossible to divide it. Then *all* indivisibility is theoretical in this way: both the impossibility, and what is to count as a division, need to be specified by some theory. In terms of that theory modalities are set up (which gives a sense to "impossible"), and a whole-part relation specified (which gives a sense to "division")

Given this general point, there really is little to be gained by seeking to put an answer to the question "In what way is the Democritean atom indivisible?" in terms of the supposed alternatives "theoretically or physically". The Democritean atom is theoretically indivisible in that its indivisibility is required by the Democritean theory — required, that is, to account for sensory evidence of plurality in the world and to avoid the contradictions consequent upon allowing divisibility everywhere. There is a difference, then, between the indivisibility of the atom and the indivisibility of a piece of rock or diamond. But in both cases the obstacles to an actual separation of parts are hardness and solidity, in the case of the atom, as I have outlined above, in the case of diamond, because its hardness will be due to a relative absence of void. But neither of these characterizations, as physically or theoretically indivisible, explains anything about the indivisibility of the atom. For that explanation it is necessary to provide the "everywhere alike" account.

Plainly, though, commentators who talk of theoretical indivisibility may have some further explication of "theoretical" and "division" in mind. We have seen that Furley explains theoretical indivisibility by reference to a type of division (a distinction of parts within something by the mind), but we have also seen that this explanation leaves a lot to be desired. Jonathan Barnes, too, looks at what theoretical indivisibility might mean.²³ Some consideration of what he has to say leads on naturally to a discussion of partlessness as being the only viable explication of theoretical indivisibility.

Barnes offers the following. By theoretical indivisibility might be meant (a) conceptual indivisibility, (b) geometrical indivisibility, or (c) logical indivisibility. Now (a) is just the Epicurean notion whereby, as with the power of sight, there is a lower limit to the power of thought. We have seen already that this Epicurean notion does not give any clear sense to talk of theoretical indivisibility. As regards (b) and (c), the distinction between them seems unclear. If we take theoretical indivisibility as (c), then the claim that atoms are theoretically indivisible is the claim that "if *a* is an atom, then it is logically impossible to divide *a*".²⁴ But this seems unlikely to give us any useful exegetical notion, unless it collapses into (b), that atomic volumes contain no mathematically distinguishable parts. For it is plain that the Democritean atomic theory is an *a priori* theory. Now to show *a priori* that there are atoms is to show that there is a *logical* contradiction — since there are no other types of contradiction — in supposing that any and every bit of matter can be divided. It will be a matter of logic that there are atoms, whether the atoms are very hard bits of stuff or whether they are of mathematically indivisible volume.

²³ Barnes, *op. cit.*, Vol. 2, pp. 54 f.

²⁴ *Ibid.*, pp. 54 f.

For the point of the Zenonian arguments is that there is a logical difficulty in supposing matter to be infinitely divisible.

But now it may seem that I am being obtuse. For, it may be objected, there is a concept at hand that *will* explain the notion of theoretical indivisibility, namely, partlessness. This is precisely what Barnes suggests as his (b): "the volume occupied by an atom has no mathematically distinguishable parts".²⁵ The theoretically indivisible will be what has no parts, and so cannot be divided, as opposed to what does have parts but cannot be divided into them. So we see that commentators take as important evidence in favour of the atom's being theoretically indivisible Simplicius' remark at DK 67 A 13 that Leucippus and Democritus hold the atom to be indivisible not only because of its impassivity, but also due to its smallness and partlessness (ἀλλὰ καὶ τὸ μικρὸν καὶ ἀμερές).²⁶

In the remainder of this paper I will consider what can be said about the partlessness of the atom. In the course of doing so I will consider the role of the notion of partlessness in the Eleatics, and what is to be said in general about the partless.

A constraint on any sensible interpretation of Democritus is that plainly the atoms differ in size. If someone claims they are also partless, then if we are to take this as clarificatory we need an explanation of how partlessness is consistent with variation in size. Those commentators who give interpretations in terms of theoretical indivisibility somewhat neglect this. Furley, for example, notices the problem, but does not tackle it.²⁷ Konstan thinks there would be a conflict between the partlessness of atoms and the existence of very large atoms.²⁸ But it is unclear what problems are raised by the existence of large atoms that are not equally obviously raised by the existence of atoms of different

²⁵ *Ibid.*, p. 54.

²⁶ See for example Furley, *op. cit.*, p. 94. Or Guthrie, *A History of Greek Philosophy* (Cambridge University Press, Cambridge, 1965), Vol. 2, pp. 127–135.

²⁷ Furley (*op. cit.*, p. 97) writes: "... Democritus' atoms were supposed to be so small that distinctions could not be made inside them. Yet they had some magnitude and many variations in shape and size. There seems to be an inescapable contradiction here." He is content though to go on to make textual objections to Luria's heterodox view that the Democritean atom, like the Epicurean, was theoretically divisible into minimum parts.

²⁸ Konstan, "Problems in Epicurean Physics," *Isis* 70 (1979), pp. 394–418. See p. 399, note 17: "There is a tradition that Democritus believed that atoms could be very large, even the size of the cosmos; ... If this is credible, then the argument for indivisibility on the grounds of smallness or partlessness must go."

sizes, even if all small. It is not clear then that the notion of partlessness could give a philosophically sensible account of the indivisibility of the Democritean atom.

Whether or not atoms have parts cannot be settled by reference to the quoted words of Democritus, nor to explicit doxographical reports. Philoponus reports that Democritus said that the soul was partless,²⁹ meaning that it is not differentiated into faculties. There are two reports concerning the partlessness of the atom, but both are elsewhere contradicted by their reporters. At DK 67 A 13 Simplicius compares Democritus and Leucippus with Epicurus: Leucippus and Democritus have not only impassivity (ἀπάθεια) but also smallness and partlessness as causes of the indivisibility of the atom; Epicurus later dropped partlessness.³⁰ This is not conclusive. It could well be Simplicius' report of the *Epicurean* account of the difference between themselves and the earlier Atomists, and so little evidence that Democritus said anything about the partlessness of the atom.³¹ Anyway Simplicius himself contradicts this, Luria pr 212: there is this sense of "indivisible", having parts and magnitude ... like each of the Democritean atoms. There is no reason to prefer one report to the other.³² Second, Aëtius, DK 68 A 48, refers to the atoms as partless bodies: οἱ τὰς ἀτόμους, περὶ τὰ ἀμερῆ ἴσασθαι καὶ μὴ εἰς ἀπειρον εἶναι τὴν τομὴν.³³ This would be an untrustworthy piece of evidence as the *sole* basis for supposing that Democritus held the atom to be partless. Aëtius himself is one of those who reports Democritus' view that some atoms are very large, DK 68 A 47: "it is possible for there to be world sized atoms". So here we have a clash of evidence, with little reason to prefer one to the other. Thus the doxographers are inconclusive over the partlessness of the atom.

But there might be indirect evidence that the Democritean atom was taken to be partless. I said earlier that the atomic theory was a reaction to Eleaticism. If the Eleatics claimed to show that the whole of what there is is partless, or if a reply to any of their arguments would require a partless entity,³⁴ then in charity we could suppose the Atomists to

²⁹ DK 68 A 105.

³⁰ See also Stobaeus, *Ecl.*, 1.14.1.

³¹ I owe this suggestion to David Sedley. I heard him make it in a seminar. I do not know whether he agrees with this use of it, or even whether he intended it as anything more than just a suggestion in passing. Compare the similar suggestion at Sorabji, *op. cit.*, p. 356, note 27.

³² Furley, *op. cit.*, p. 95 says that Simplicius' "hasty reference" at Luria, par. 212 (in *Phys.* 82.1 on) "should not be preferred"; but that assertion seems to be unsupported.

³³ Luria, par. 106, also from Stobaeus: Δημόκριτος ... περὶ τ'ἀμερῆ ἴσασθαι τὴν τομὴν.

³⁴ It is sometimes claimed that only partless entities would avoid Zenonian arguments. For example, Sorabji, *op. cit.*, p. 356. I will discuss whether or not the Zenonian arguments require a notion of partlessness below.

have seen that, and accordingly made the atom partless. Even if that were the case, it would still only be a start. In order for the notion of partlessness to cast any light on the indivisibility of the atom we should need to understand how the Atomists rendered partlessness and variation in size consistent.

First, though, it is unclear that the Eleatics *did* argue the whole of what there is to be partless. Parmenides did not mention partlessness. Nor did Zeno. The term “partless” does occur in certain passages that present Eleatic reasoning. For example, in Simplicius in Phys. 139.27–140.6³⁵ the term “partless” occurs twice. The argument there is claimed to show that what there is is just one, and both partless and indivisible, and the conclusion is that what there is is indivisible and partless and one. But nothing in the argument requires partlessness, over and above the conclusion that the whole cannot be divided. Use of “partless” could easily be an inference by the doxographer from “one”. The pseudo-Aristotelian *De Lineis Insecabilibus* is concerned with partless things,³⁶ and reports as conclusion to a Zenonian argument that there exists a partless magnitude: “Again, Zeno’s argument proves that there must be a partless magnitude” (968a2). But this is a later work, and “Zeno’s argument” seems to refer just to a dichotomy argument. We are given refinements about the traversal in thought of a magnitude, and the counting of an infinity, which are almost certainly later refinements and not from Zeno. So this gives little ground for supposing that Zeno argued the whole to be partless.

Now Melissus *does* link being one with being partless.³⁷ But we know that Melissus differed from Parmenides in some respects, and we might have a case in point here. I will say considerably more about the points raised by what Melissus says later. For the present, as regards Parmenides consider also DK 28 B 8.25: “the whole is continuous, for what is clings close to what is”. This is something accepted as true by Parmenides. But then *what* clings close to *what*? Not one entity to another, since there is just one indivisible being. The natural thing for us to say is: one part of a single indivisible whole to another.³⁸ But there should be no cause for concern here, unless it is supposed that having parts is *ipso facto* being divided. It will emerge presently, though, that there is much confusion in that notion of what divisibility is, and it will become clearer what the talk of parts and partlessness comes to.

Perhaps consideration of the *texts* of Parmenides and Zeno does not require introduction of a notion of partlessness. However, it is often thought that Zeno’s dichotomy arguments, while they do not *mention*

³⁵ The argument of this passage is discussed and analysed in my “Zeno on Plurality.”

³⁶ *De Lineis Insecabilibus*, 968a2.

³⁷ Melissus B 9: εἰ δὲ ἔχοι πάχος, ἔχοι ἂν μύρια, καὶ οὐκέτι ἓν εἴη.

³⁸ There is something paradoxical in the remark by Stokes, *op. cit.*, p. 135: “in respect of being there is no distinction between the parts (which makes it difficult to talk about parts at all, and Parmenides sedulously avoids doing so)”.

parts, are aimed at what has parts, and would be avoided only by a partless entity.³⁹ As a result both the Democritean atom and the Eleatic One are taken to be partless.

The best way to approach this matter is through consideration of a problem. At DK 29 B 2.17f. Simplicius refers to an argument of Zeno's in summary: "he shows this having shown first that each of the many has no magnitude since each is the same as itself and one".⁴⁰ The inference is generally expanded via mention of partlessness, with Melissus B 9 in mind. If something is self-identical and one, then it is partless, and so has no magnitude. Now suppose we add Zeno's argument B 2 that what has no magnitude is nothing and does not exist. But the Eleatic One is one and self-identical. Then it will not exist by Zeno's argument, and the inference will be strengthened if it is partless. How might this conclusion be avoided?⁴¹

The argument summarised by "each of the many has no magnitude since each is the same as itself and one" is aimed at each of the many. It does not apply to the Eleatic One, since the Eleatic One is not the one of a plurality — a putative unit. Zeno's point can be explained by reference to the principle that any plurality requires a unit of which it is a plurality.⁴² Whatever the criteria are by which something is judged to be a plurality, there need to be units which are units *by those criteria*. On that basis Zeno can make this charge against his pluralist opponents. If you take the whole to be a plurality because it is obviously differentiated into this thing and that thing,⁴³ then by those criteria the unit will require to be non-differentiated (self-identical). But it is only insofar as it is extended that you suppose the whole to be a plurality, in which case the unit will be something non-extended.

³⁹ See for example Furley, *op. cit.*, pp. 85f. and the passage cited from Sorabji at note 34 above.

⁴⁰ Reading as Frankel, rather than Diels-Kranz who put ἐκ τοῦ before ἑκάστων. See Frankel, "Zeno of Elea's Attacks on Plurality," in *Studies in Presocratic Philosophy* (Routledge and Kegan Paul, London, 1975), Vol. 2, especially pp. 110f. and notes.

⁴¹ It is possible of course that just such considerations lead to the view that Zeno did away with the One and the Many. See Eudemus at DK 29 A 21. On Zeno's support for Parmenides see my "Zeno on Plurality," note 6.

⁴² This form of argument, based on the move "plurality presupposes a unit" is often attributed to Zeno. See the reports of Simplicius and Philoponus at DK 29 A 21, and of Eudemus at 29 A 16. The argument is common also in later philosophers. See for example Leibniz, *The Leibniz-Arnauld Correspondence*, tr. H. T. Mason (Manchester University Press, Manchester, 1967), p. 121, from Leibniz to Arnauld 30 April 1687. Also Hume, *A Treatise of Human Nature*, 1.2.2, ed. L. A. Selby-Bigge (Clarendon Press, Oxford, First Edition, 1888), pp. 30f.

⁴³ See the passage from Philoponus in Phys. 42.9 on (partly at DK 29 A 21), given by Lee, *Zeno of Elea* (Cambridge Classical Studies: Cambridge University Press, Cambridge, 1936) at par. 8: the opponents of Zeno base their support for a plurality on its obviousness (ἐνάργεια).

But there could be no such unit, and thus there could be no such plurality as the pluralist alleges.

On this account the thrust of "each of the many has no magnitude since each is the same as itself and one" is not that *any* unit must have no magnitude, but that what is a unit by the pluralist account of what is a plurality must have no magnitude. Since the pluralist is in no position to differentiate between the whole and any putative unit (since both will be extended things), to arrive at a unit that *is* distinguished from the plurality of which he takes it to be a unit he will need to make it non-extended.

Now the Eleatics can avoid all this. Since they don't suppose the whole to be a plurality in the first place, they do not require any unit which would drive them to the non-extended to ground the plurality. The Atomists too can avoid these difficulties. By introducing the void as non-being they can give an account of why the whole is a plurality — it contains void. Then the unit required by those criteria of what a plurality is would be something that did not contain void, i.e. the atom. Since the Atomists do not judge the whole to be a plurality just in virtue of its being extended, nothing in their arguments suggests that the unit required should be non-extended.

The upshot of these remarks on "each of the many has no magnitude since each is the same as itself and one" is that however that argument be expanded as regards the pluralists against whom it is aimed, it does not imply that the *Eleatic One* was an entity taken to have no parts, since the argument is not applicable to the Eleatic One at all. As a result, therefore, the argument does not tend to suggest that the Democritean Atom would need to be an entity with no parts either.⁴⁴

The argument of Zeno B 1 is also commonly taken to generate the notion of a partless entity, so that, if Atomists are to respond to that argument, then the atom will need to be a partless thing. The sense of B 1 can be put as follows.

- (1) If there is 'a plurality' each thing must have some magnitude or depth, and one of it must be far from another.⁴⁵
- (2) The same story applies to what is in front. For it too will have a magnitude, and some of it will be in front.
- (3) It is all the same to say this once and to say it over and over.
- (4) For no such thing of it will be last, nor will one not be opposed to another.
- (5) So if there is a plurality, the same things must be both small and large: so small as not to have magnitude, so large as to be infinite.

The argument draws absurd consequences from the supposition "if there is a plurality". The central idea, which powers the argument, is that once division into a plurality gets going it can never be stopped. No support for this, e.g. for step (3) in the text as given, is provided. But the line that Zenonian support would take

⁴⁴ It can also be seen from what I have said of the argument that the summary given, along with the rest of B 2, does not threaten the view of Zeno as a supporter of Parmenides. On this, compare note 41 above.

⁴⁵ The opening *ἐἰ δὲ ἔστιν* of B 1 is just hanging: "if it is *what*" or "if *what* is" From B 8.10 (*οὕτως ἐἰ πολλὰ ἔστιν*) *πολλὰ* or *τὰ πολλὰ* is intended.

should be clear. Because the whole is everywhere the same, as being, since there is no non-being or void, any division only up to a certain point would be arbitrary. So if there is any point of divisibility within the whole then every point is a point of divisibility. Once (3) is granted the argument goes ahead. It is clear why the absurdities are conditional upon there being a plurality, hence "if there is a plurality" in (5). If there is a plurality, then the putative constituent units — "each thing" in (1) — must have magnitude and depth, otherwise the whole which they compose could not have magnitude and depth. It is precisely such a whole that Zeno's opponents want to save. Furthermore the units must be 'separate' from one another. But any putative unit will be in just the position of the whole, so that it too can be considered as a plurality of units. Since there is no end to this, (4), the absurd conclusion follows, doubtless via the view that an infinite collection of parts each of which has magnitude must itself have infinite magnitude.

What can be told from this argument about the indivisibility of the atom, assuming that the atom is indivisible in a way necessary to avoid the conclusion of the argument? One point we can start from is that the atom is indivisible in the same way as is the Eleatic One, since in the case of each, the argument is applied in the same way. We can tell from the logic of (1)–(5), as a *reductio ad absurdum* of "there is a plurality", that the argument shows the existence of what is not a many. But why does it follow from that that the Eleatic One has no parts? Presumably because it is held that, if the Eleatic One *did* have parts, then it would not be one but many.⁴⁶ But why should *that* be believed? Perhaps it might be thought obvious. But if *that* is thought obvious then what are we to say about Democritean atoms which will be, by the same argument, partless and yet various in shape and size?

It seems just as obvious that partless bodies cannot differ in shape and size as that a body which is one, and not many, is a partless body. If we want a philosophically reasonable account of the indivisibility of the atom, and we want to be reasonably charitable about what Democritus understood about the philosophical problems raised by the notions of unity and plurality, then one of these implications has got to give. Either partless bodies can differ in size and shape, or there is a concept of unity (indivisibility) unconnected with that of partlessness and adequate to avoid the Zenonian argument. Now the latter is the preferable alternative, for indeed there *is* a concept of unity (indivisibility) grounded in homogeneity, viz. the "everywhere alike" concept, that is distinct from the notion of a partless body. That concept would be at home in the context of the Zenonian argument, since it is the notion of homogeneity that grounds the step (3) that generates the conclusion of the argument. In terms of this concept it can be seen

⁴⁶ As Melissus B 9, ... ἔχει ἄν μέρος, καὶ οὐκέτι ἐν εἴῃ.

that the Zenonian argument works *both* against Zeno's 'crude' (non-atomistic) pluralist opponents, *and* how it can be used positively by the Eleatics and Atomists. For what the argument shows is that, if something is ever divisible, then it is divisible *ad infinitum*, which is absurd.

Now we have a notion — homogeneity — which explains the indivisibility of the Eleatic One and of the Democritean atom. Consider, then, what role is left for the notion of partlessness in casting light on what is going on. In Parmenides the unity of the One is grounded in its homogeneity and continuity. We would naturally explain these notions of homogeneity and continuity as relations between parts. That is, it is homogeneous because every part is just alike being. If this is the correct way to explain homogeneity and continuity, and if those notions explain indivisibility, then, since neither Parmenides, Zeno nor Democritus *say* that unity is grounded in partlessness, the Eleatic One, and the Democritean Atom, will each emerge as an entity with parts that cannot be divided from one another.

Now this is not to say that Parmenides and Zeno held the One to have parts. The important points are rather these. There is no explicit statement in Parmenides or Zeno that the One is partless, or one in virtue of its partlessness. Zeno's arguments do not generate that as conclusion. If commentators on Zeno B 1 are to be believed, the partlessness of the Eleatic One would entail its non-existence. Zeno B 1 argues from the supposition that there is some plurality to the absurd conclusion of infinite size. Support is here provided by the homogeneity argument. It does not make the argument any clearer to insist that Zeno B 1 would tend to prove the existence of a partless body, unless it can first be made clear what it is to have parts and what it would be for the extended to be partless. Nothing in Parmenides or Zeno says that the One *has* parts either, though homogeneity and continuity might naturally be explained in terms of parts. The crucial point is that the explanation of how the Eleatic One *is* one and indivisible, because homogeneous, makes no reference to parts, and the notion of parts is not so independently clear as to impress itself upon the explanation. In Parmenides, the One is indivisible due to its homogeneity and continuity. This notion also occurs in doxographical reports of Zeno.⁴⁷ Zeno B 1 and B 2 do not controvert this approach. In fact, B 1 and B 2 require the notion of homogeneity.

⁴⁷ See the discussion in my "Zeno on Plurality".

It does appear however that Melissus links being one with being partless, at DK 30 B 9: "if it had bulk, it would have parts, and would no longer be one".⁴⁸ This raises some difficulty for the claim that it is no part of Eleatic thought concerning divisibility and indivisibility that being one (indivisible) entails being partless.⁴⁹

I will later consider, in abstraction from exegetical concerns, the *philosophical* question of how the notion of partlessness is to be given a sense. In that connection I will argue that the concept of having parts whereby something has parts just in virtue of being corporeal is a wholly unclear concept. That then gives us reason not to rely on that concept in order to explain Eleatic and Atomist thought. I will here consider the exegetical question of whether Melissus B 9 provides any substantial indirect evidence that the Democritean atom should be taken to be partless.

We can start from what we have already established about Parmenides and Zeno. We have seen no positive grounds for supposing that Parmenides and Zeno took what there is to be partless. More than that we have seen that reading partlessness into Parmenides' and Zeno's discussions would generate some difficulties: for example, as regards Parmenides B 8.25, or Zeno B 2. These conclusions stand independently of what we say about Melissus B 9. So if we take Melissus B 9 at face value we *have to* conclude that on this issue Melissus is at variance with Parmenides and Zeno. This conclusion should generate no great difficulty, for we know that Melissus differed from Parmenides in some respects and this *must be* such a case. There is a tradition that Melissus' grasp of the issues discussed by the Eleatics tended to be crude.⁵⁰ Given this, it is reasonable to suppose that Democritus is reacting to the thought of Parmenides and Zeno rather than to the somewhat divergent, and slightly cruder, thought of Melissus. This exegetical conclusion will be borne out later, when we see that Melissus' notion of indivisibility as involving partlessness cannot have any coherent application to the Democritean account of a plurality of indivisible bodies of differing sizes and shapes.

⁴⁸ εἰ δὲ ἔχει πᾶχος, ἔχει ἂν μέρη, καὶ οὐκέτι ἓν εἴη.

⁴⁹ I would like to thank an anonymous referee for *Archiv für Geschichte der Philosophie* for emphasising the importance of the difficulties posed by Melissus B 9.

⁵⁰ See Aristotle, *Phys.* 186a8 f., *Met.* 986b26 f. More recently Barnes has contested this opinion, *op. cit.*, Vol. 1, pp. 180 on. But the passage he quotes from Plato, *Theaetetus* 183 e, agrees exactly with Aristotle's estimate at *Met.* 986b26 f. of the relative merits of Parmenides and Melissus.

We might wonder anyway whether Melissus B 9 can bear a great deal of exegetical weight. Firstly, there is some tension between B 9 and the assertion of homogeneity, for example at B 7.3 f., "In this way, then, it is eternal and infinite and one and all the same,"⁵¹ or at Aristotle, *De Mel.Xen.Gorg.* (DK 30 A 5) 974 a 13 f.: "Being one it must be the same throughout; for if it were not the same, it would be several and thus no longer one but many". For, as with Parmenides B 8.25, how can something be *all* the same if it is a partless entity? For what is the same as what? If *it* (the partless entity) is the same as *it*, then it is inappropriate to talk of it as *all* the same, since "all" suggests some sort of plurality. On the other hand, if it is partless we cannot say what it would be most natural to say, that homogeneity is a relation holding between the parts of a thing.⁵²

Secondly B 9 seems contradicted by other texts of Melissus, for we can find a reasonable amount of evidence that Melissus did not hold that what there is is incorporeal. For example, according to B 3 it is unlimited in magnitude. According to B 7.34 f. it must be full because it is not empty. According to B 7.33 f. it neither gives way nor receives. Further *De Mel.Xen.Gorg.* appears to assert that what there is *is* corporeal (for example at 976a10–13 and in passing at 976a21 f.). If B 9 should, on these grounds, be held suspect and unreliable, then, in the face of reasonably clear indications that neither Parmenides nor Zeno rely on the notion of partlessness to do any philosophical work, we should not take Melissus B 9 as substantial evidence that in the Eleatic background to which the Atomists are responding there is a concept of indivisibility based on partlessness.⁵³

The consequence of all this as regards the Democritean atom is that we cannot conclude from the fact that the Democritean atom was intended to evade Eleatic arguments that it was a partless body.

There is another contribution that Zeno is thought to have made to the account to be given of the Democritean atom besides that deriving from the arguments against plurality. There is a view that partless atoms are required to answer Zeno's arguments about motion and traversal. Furley is explicit about this.⁵⁴ If an atom had parts, then it could never be traversed in thought. For if one imagines half then one has to imagine half of the remainder, and then half of a remainder and so on

⁵¹ οὕτως οὖν ἄδιον ἔστι καὶ ἄπειρον καὶ ἐν καὶ ὁμοῖον πᾶν.

⁵² It is interesting to notice that a similar point is made at *De Mel.Xen.Gorg.*, 976a13 ff., about the homogeneity of the universe.

⁵³ Barnes, *op. cit.*, Vol. 1, pp. 226 ff. discusses the difficulties of reconciling B 9 with other of Melissus' texts. Somewhat hesitantly, Barnes adopts the view that B 9 is not about the Eleatic One, but is part of an attack on the pluralist opponents of Parmenides. If that is the correct account to give of B 9, then the question arises of whether, for the opponents of the Eleatics, having parts would entail being many. That question, and its relevance to the account to be given of atomic indivisibility, has already been dealt with in discussion of Zeno B 2 and B 1 in the body of this paper.

⁵⁴ Furley, *op. cit.*, p. 86.

Talk of "movement in thought" is a refinement to Zeno's argument,⁵⁵ but that refinement is not necessary to cause a problem for the Atomists. Since atoms move, it will happen that one passes in front of another. But how is that possible? For first it must pass in front of half of it, and then in front of half the remainder, and so on. The thought is that had the Atomists reacted to an Eleatic argument, they would have required a response to this. A partless atom is presumably the response needed. And so Democritean atoms are viewed as being partless.

But really, this is not at all convincing. First the tension between atoms as partless and atoms as of different sizes is all the more obvious. If A cannot move across B part by part, because B is partless, then A cannot differ in size from B either. For suppose A is smaller than B. Then what growth would be necessary for A to be the same size as B? It would first have to increase by half the difference, then half the remainder and so on. It is not relevant that atoms cannot change in size. The example brings out that if atoms differ in size then we can consider the difference between them in such a way as to imagine movement across it. But this is not possible if movement is of partless atoms. Second, it is not sufficient to have partless atoms. A partless structure for space would be required too.⁵⁶ For how can one atom ever come into contact with another? First it would have to cover half the distance between them, and then half the remainder, and so on. If the Atomists knew Zeno's dichotomy argument, and posited partless atoms in order to avoid it, then it seems hard to suppose they were so unobservant as not to notice its application to space. Doubly hard, since the Achilles is immediately applicable to atomic motion. How could one atom ever catch up and collide with another? But there is *no* evidence that Leucippus and Democritus had an atomic account of time and space. Then there seems as little reason to say that Democritus upheld partless atoms because he would have to avoid the Zenonian dichotomy arguments, as there is to say that he upheld partless spaces because he would have to avoid Zenonian arguments.

A question does remain though: how *did* Democritus answer Zenonian arguments against motion? For the Democritean theory was intended to save both plurality and motion. Zeno presented arguments against both, but I have given an account only of the Democritean reply to the arguments against plurality. It would be implausible to say that the Atomists never knew of the Zenonian arguments against motion. But it is certainly true, as Aristotle's account of the origins of the Atomic Theory in GC 1.8 suggests, that the arguments against the possibility of motion that worried the Atomists most were not dichotomy arguments but those based on the impossibility of motion without void. It seems equally implausible to say that

⁵⁵ On the argument thus refined, see Epicurus, *Letter to Herodotus*, par. 57; pseudo-Aristotle, *De Lineis Insecabilibus* 968a27; Aristotle, at *Physics* 8.8 263a27 *on*; Simplicius, *In Phys.* 1289.5 *on*.

⁵⁶ Also for time. These links were made by Aristotle, *Physics* 6.1, and in the atomist tradition by Diodorus Cronus. On the atomism of Diodorus Cronus, see Denyer, "The Atomism of Diodorus Cronus," *Prudentia* 13 (1981), pp. 33–45. See also Sorabji, *op. cit.*, chap. 24.

Democritus and Leucippus adopted a granular structure for space and time. Perhaps Democritus had some mathematical refutation of the error in Zeno's arguments, concerning the infinite series employed,⁵⁷ which has not survived. Or perhaps he held that the arguments did not apply to void since, being nothing and empty, there was no sense to considering *it* divided progressively. At least we have no positive evidence at all from the Zenonian paradoxes of motion that Democritus held the atom to be partless.

I have argued that there is nothing in the texts and doxographies of the Eleatics and Atomists to justify us in basing a notion of indivisibility on partlessness — in effect, nothing to rehabilitate a notion of theoretical indivisibility. I will now approach this matter from a slightly different angle, by considering, in abstraction from exegetical concerns, how the notion of being partless is to be given a sense. It will then follow, first, as regards the Eleatics, that the question whether or not the One has parts is senseless; second, that sense *can* be given to talk of the parts of the atom; third, that we must talk of the atom as what has parts, but cannot on pain of absurdity be divided into them.

One idea would be that having parts and being divided should be explained together, so that if one is clear then so is the other. This suggests the following account of partlessness.⁵⁸ Something has actual parts if it is actually divided into them; actual parts are the parts produced by an actual division; something has potential parts when it could be divided; its potential parts are what it could be divided into. Then what cannot be divided will have parts neither actually nor potentially. The partless is just the indivisible.

This is all right as far as it goes, but really it clarifies nothing. Should we say, in terms of this notion, that the Democritean atom is partless? On the one hand, it seems, yes. It *cannot* be divided on pain of absurdity, since if it could be divided anywhere, it could be divided everywhere, which is taken to be absurd. On the other hand, it seems, no. If one atom is larger than another, then the smaller atom is the same size as part of the larger, and can move across part of the surface of the larger. One might, of course, not call this dividing. This is precisely the crux of the matter. What is to count as a division and what is to count as a part have yet to be specified. There is no *general*

⁵⁷ This suggestion was made to me in passing by David Sedley.

⁵⁸ This account was suggested to me by Nicholas Denyer, as an account that an Aristotelian might give of the partless. If it appealed to some Aristotelian commentator, then we can see how the partlessness of the atom got into the tradition of discussion of the early Atomists. For the Democritean atom is without doubt what cannot be divided.

sense to “having a part” or “being a part,” and so no sense to the *general* question “does such and such have parts?”. This is why debate over the question “does the Democritean atom have parts?” is likely to be confusing and fruitless.⁵⁹

It is specified what are to count as parts of a thing when it is specified how parts are to be marked out. For this reason the general question “does such and such have parts?” is empty. The best that the partless *simpliciter* could be would be that of which parts cannot be marked out in any way whatever. But it is surely implausible to suppose that the Democritean atom, or indeed anything whatever, could be in *that* way partless.

The importance of specifying the parts of a thing by saying how they are to be marked out can be seen by consideration of the question “how *many* parts does such and such have?” Like the question “does such and such have parts?” it is senseless in its general form. Take a very clear case. Suppose we specify of the human body that we want its parts marked out by function. Then clearly enough it has parts — for example, heart and liver — though we may not be able to count them, due to some unclarity over what is to count as the same function. If, alternatively, we specify that parts are to be marked out by the way in which their reproduction contributes to the reproduction of the whole body, then we will take cells to be parts of the body, since within the body it is cells that reproduce to give cells and not, for example, organs that reproduce to give organs. It would then be possible to count the cells in the body at a given time. By that account, a cell would be one of the partless constituents of the body. Specifying how a part is to be marked out gives a sense to the notion of partlessness. Without such a specification the notion of partlessness has no sense.

Now when we consider the Eleatics and Atomists, we plainly do not have such a clear cut example of the specification of parts as with the human body. But attempts to specify what are to count as parts can still be seen in the case of the Eleatics and Atomists, and those are *ipso facto* attempts to give a sense to the notion of partlessness. Consider the Epicurean analogy with the minimum visible. In that case parts are marked out by sight. A patch has visible parts if I can see

⁵⁹ As regards this account of the partless-as-indivisible in the history of discussion of the atom, what sense does it allow us to make of Simplicius' characterisation at Luria par. 212 of a sense of ἀδιαίρετον thus: ... ἡ τῶ μῦρια ἔχειν καὶ μέγεθος, ἀπαθὲς δὲ εἶναι διὰ στερορτήτα καὶ ναστοτήτα, καθάπερ ἑκάστη τῶν Δημοκρίτου ἀτόμων?

something smaller. What has no visible parts, the minimum visible, is that than which I can see nothing smaller. An explanation can be provided for that inability to see something smaller. It is due, as we would say, to some facts about light and vision. But this analogy would not provide any general account of the partless. What has no parts would presumably be that than which there can be nothing smaller. But at once the question of *why* there cannot be anything smaller arises. If *that* question cannot be answered, then the sense in which there *cannot* be anything smaller is opaque, and really nothing is explained. Why might I not just insist that there always is something smaller than any given thing, namely half of that thing?

In the case of the Eleatics it is opaque what the marking out of parts could be. Parts could not be marked out by any other thing or any movement, for the Eleatic view is that there is just one thing and no movement. It is similarly opaque how parts could *fail* to be marked out, for there is no other thing or motion by reference to which a marking out could fail. The upshot of this is that it is unclear whether the Eleatic One has parts or is partless, since it is unclear what the sense of talk of partlessness is in this instance.

Plainly enough, when commentators such as Furley talk of the impossibility of drawing mental distinctions within the One, what they are after is some sense for the marking out of parts. The view would be that parts are marked out by the mind, and since no marking out by the mind is possible within the Eleatic One, it is partless. The trouble with this is that the notion relied on for explanation, i.e. marking out by the mind, really is no clearer than that purportedly explained, i.e. having parts. It does not have the recommendation of being the Eleatic's own favoured mode of explanation, nor is it in itself clear. What stops me making mental distinctions within a thing? How do I try to perform such a division? Surely if a thing *did* have parts, it *would* be possible to consider them separately, so that having parts should explain the possibility of distinguishing them mentally, and not *vice versa*. Further, what would be gained by attempting to make clear a sense of marking out parts, in terms of which we could then say that the Eleatic One is partless? This in itself will not cast any light on *how* the Eleatic One is indivisible and one, for that is to be explained in a different way, in terms of homogeneity and continuity. So the attempted account would be superfluous and confusing.

Perhaps some sense of having parts can be got out of what Melissus writes at DK 30 B 9: εἰ μὲν οὖν εἴη, δεῖ αὐτὸ ἐν εἶναι, ἐν δ' ἔδον δεῖ αὐτὸ σῶμα μὴ ἔχειν· εἰ δὲ ἔχῃ, πᾶχος, ἔχῃ ἂν μόρια, καὶ οὐκέτι ἐν εἴη. This embodies a common view of what

constitutes the possession of parts and partlessness, still presented as an account of a type of indivisibility by commentators. For example, Guthrie writes:⁶⁰

What is one ... is a single whole, without parts, on the primitive logical ground that one and many are contradictory attributes which cannot apply to the same thing ... the atoms were for Leucippus and Democritus without parts, logically as well as physically indivisible, although each was a physical body possessed of a certain magnitude. The infinite divisibility of matter was inconceivable.

There are two views combined here. First that something could have parts just in virtue of being corporeal. This is clearly what Melissus intends by εἰ δὲ ἔχει πάχος, ἔχει ἄν μῆκος. Second that what has parts is *ipso facto* many. But what is the sense of "having parts" whereby it follows from its being corporeal that an entity has parts? What, for example, does Guthrie mean by the *logical* divisibility of a magnitude? There may be some idea of a *mathematical* construction. Given a certain geometrical theory, it is always possible to construct a magnitude smaller than a given magnitude. The extension to the possession of parts by a body would then be this. What is corporeal is some stuff, and therefore has a certain magnitude, and given the geometrical theory one can always take a smaller magnitude than a given magnitude.⁶¹ But then to hold that a body is partless would rest on a finitist geometry. If this is what is involved in the very concept of partlessness, then, apart from any purely philosophical problems we may find with a finitist geometry, that concept of partlessness will not be of help in discussion of the Eleatics and Atomists. For there is little evidence of any finitist geometry in connection with the Eleatics or Democritus.⁶²

We might further ask *why* having parts should pose any threat to the unity of a body, allowing that being corporeal is *ipso facto* having parts. Certainly the Eleatic entity and each Democritean atom are one and not many. They *cannot* be divided. A perfectly good explanation can be given, in terms of homogeneity and continuity. What more could be required to secure the unity of those entities? There might be the feeling that it is necessary to say explicitly that the One, for example, is partless. Otherwise it will seem to be in some way many. But no explanation of being partless is offered, and the notion appears as just an idling addition. It is better to abandon the question "partless or not?" in connection with the Eleatics, once it is seen that there is no mention of finitist geometry. As regards the atoms there is a perfectly good account of the unity of the atom (παντὴ ὁμοῖον), and an account of "having parts", to be given below, which does not threaten that unity. This is preferable to reliance on unexplained and unclear notions of partlessness and logical indivisibility.

⁶⁰ Guthrie, *op. cit.*, Vol. 2, p. 503.

⁶¹ This is the way that a scholiast on Euclid 10 takes the Democritean theory. See DK 68 A 48a; the text is given more fully at Furley, *op. cit.*, p. 98, note i: ὅτι οὐκ ἔστιν ἐλάχιστον μέγεθος, ὡς οἱ Δημοκρίτειοι φασίν, καὶ διὰ τούτου τοῦ θεωρήματος δεικνύται, εἰ γε παντὸς τοῦ ἐνκειμένου μεγέθους δύνατον ἑλαττον λαβεῖν.

⁶² On this see Vlastos, "Minimal Parts in Epicurean Atomism," *Isis* 56 (1965), pp. 121–147, especially pp. 125–131.

There is the sense of partless in which what is unextended is partless, for example the geometrical point. But that sense will not be of help in discussion of the partlessness of the Eleatic and Atomist entities. First, there is little reason to think that the Eleatic One is punctiform. According to Parmenides it is like a sphere,⁶³ while according to Zeno B 2 its being without magnitude would entail its being non-existent. Second, even if it could be made plausible that the Eleatic One is punctiform, clearly the Democritean atom is not, and so all parallel between Eleatic and Atomist thought would be lost.

The claim that there is no *sense* to talking about parts in connection with the Eleatic One (so that the question whether or not it has parts cannot be sensibly raised) is clearer if the case of the Eleatics is compared with that of the Atomists, where there *is* sense to be attached to the marking out of parts, and if we compare the Eleatics also with those ancient philosophers who did make a stand on the partlessness of the atom, for example, Diodorus Cronus.

As regards the Democritean atoms there are clear senses to the marking off of parts, for the atoms mark off parts in relation to one another. For example, by their difference in size. It can be explained what it is for an atom to have parts thus. An atom S has parts if there is an atom S* that is smaller than S. For in relation to S what will the atom S* be the same size as? Clearly a part of S. This gives a genuine explanation of what the possession of parts is, for the relation "being the same size as" is perfectly comprehensible. Atoms will mark off parts too by moving past one another, or in virtue of their differences in shape. It is impossible to make sense of any of these notions, of difference in size and shape, and the existence of relative motion, as applied to *partless* bodies. The reason is a deep one, that the notion of a body's being partless could only be given a *sense* in terms of some one of those notions not applying.

This is borne out in those cases where a stand is made on partlessness. Diodorus Cronus believed the indivisible elements of the world to be partless bodies, and there is good reason to think that Diodorus gave an atomistic account of time and space too.⁶⁴ It is for precisely this reason that sense can be made of talk of the partlessness of the Diodoran atom. An atom of space is partless in that necessarily it is either full or it is empty, it is not possible that it be partly occupied, partly unoccupied. An atom of time is partless in that necessarily either

⁶³ DK 28 B 8.42 ff.

⁶⁴ See the collection by K. Döring, *Die Megariker*, (Amsterdam, 1972), pars. 116, 117 A – F, 120. See also Denyer, *op. cit.*; Sorabji, *op. cit.*, chap. 24.

something is so throughout it or is not so throughout it, it is not possible that it should be first so and then not so within an atom of time. An atom of stuff is partless in that necessarily either it is all in an atomic space or it is all not in an atomic space, it is not possible that it should be partly in and partly out.

So partless bodies, times and spaces are to be explained – talk of their partlessness is to be given a sense – all together, in terms of modalities applied to motions and positions. This casts some light on what Diodorus is saying, since, if someone finds the idea of a partless atom of space difficult, we can offer some explanation. To say that it is partless is just to say that necessarily either it is full or it is empty.

Notice that it *follows* from these accounts of what partlessness is that atomic spaces are all of the same size, and ultimate atomic bodies too. Suppose partless space A were larger than partless space B. Then if X were an atom of stuff occupying B, it would occupy only a part of A, which is impossible. So partless atomic spaces are of the same size. So too with atomic bodies. By similar reasoning one could show that all partless atomic bodies and all partless atomic spaces are of the same shape too.

If the sense of talk of partlessness (what partlessness *is*) can be given only by reference to possible motions and positions – and it's not clear how else it could be given – and it follows from this that partless bodies and partless spaces are all of the same size and shape, then the view that the Democritean atoms, which differ from one another in size and shape, could be partless is not just difficult to accept. It is senseless. It leaves us wholly confused as to what is meant by saying they are partless.

My conclusion concerning the Eleatics and Atomists is this. As regards the Eleatics there is no possibility of relations between time, space and bodies, for they are excluded from the Eleatic scheme. If we try to explain what the partlessness of the Eleatic One would be, in a counter-factual way, then either there is little connection with Eleaticism, and we may as well be considering Atomism – if, for example, we were to say that the Eleatic One is partless in that *if* there were another body, it *could not* move across the One part by part – or we become involved in an unexplanatory quagmire – if, for example, we were to say that the Eleatic One is partless in that one cannot mentally distinguish parts within it. With the Atomists there *are* relations of time, space, and motion, so that there is some sense to the question “partless or not?”. But the variety of atomic size and shape, which must serve as a constraint on any coherent interpretation, and the

absence of any evidence for spatial or temporal atomism in Leucippus or Democritus, make it impossible to put forward an account of the Democritean atom as a partless body that would give a view to which any coherent sense could be attached. If, therefore, we want, as interpreters, to treat the Democritean view seriously, as of some philosophical sense and interest, we are forced to see the atom as an extended body with parts, and shown indivisible by an argument, the $\pi\alpha\nu\tau\eta\ \delta\mu\omicron\iota\omicron\nu$ argument, starting from the homogeneity of the atom.⁶⁵

⁶⁵ My debt to the writings of David Furley and Richard Sorabji on these matters is apparent from the frequency of my references to them in this paper. I have benefited greatly also from hearing Richard Sorabji talk about Atomism at Seminars at the Institute of Classical Studies in London. I have benefited also from comments received from two anonymous referees for *Archiv für Geschichte der Philosophie*. I would like also to thank Nicholas Denyer and David Sedley for help received in discussion.