

Two Conceptions of Vacuum

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1. The question

Writers on ancient philosophy have always been impressed by the early atomists' conceptual breakthrough in introducing vacuum, or void, as an intelligible notion. But discussion of the concept itself has been rare and, on the whole, disappointing. It is as if the doctrine were so obviously correct and sensible that no one had paused to ask whether it really is quite *so* straightforward. My contention is that it raises considerable conceptual difficulties of its own, and that these gradually emerged, and were tackled, over a long period. I shall be concerned primarily with the theoretical aspects of void, and not with its cosmological role or with the empirical arguments for and against its existence.

Void, τὸ κενόν, is literally 'the empty'. Does that mean empty space? So it is regularly assumed. In the index to Cyril Bailey's *The Greek Atomists and Epicurus*, for example, the entry under 'void' simply reads 'see space'. But there is, as a matter of Greek usage, at least one other thing that τὸ κενόν could mean, and that is 'emptiness'. Viewed as emptiness, void would not be a kind of space or place. Rather, a portion of void would be the emptiness *in* such and such a place. And as an occupier of place, it might even be considered capable of locomotion.

There should be nothing intuitively abhorrent about the idea of something with a purely negative characterisation occupying places and moving – a gap in the traffic, for example. When you carry your thermos flask to work, you would do well to think of the vacuum in it as moving from place to place with it. If you insist instead that the vacuum in it is empty *space* and therefore incapable of moving *in* space, you may have to conclude that throughout your journey the vacuum in your flask is being replaced in a constant stream.

These considerations are not meant to tell decisively in favour of the space-occupier interpretation of void, but to show that that interpretation is not too implausible to be entertained. Whether or not a particular thinker actually adopts it, consciously or unconsciously, will depend partly on other features of his system. For example, if he considers void an element, capable of being part of a compound body and of moving around with it, he is more likely to think of it as a negative substance occupying

space; whereas if he introduces it only in order to provide room for bodies to move, he may be satisfied with the conception of it as empty space. My contention will be that the former view is characteristic of early Greek thought, but that a transition to the latter can be discerned in the fourth and third centuries, B.C.

2. *The forerunners of atomism*

It is generally agreed that the notion of absolute vacuum was first put on the map by the early Greek atomists, Leucippus and Democritus. But their work grew out of a background of theoretical debate, which we cannot afford to overlook if we are to understand their conceptual framework.

The earliest fumbling attempt to come to terms with void must be attributed to the Pythagoreans of the 6th century B.C., in whose cosmology the world is said to inhale void from the infinite surrounding breath.¹ It would be pointless in the present context to probe the precise meaning of this startling doctrine, and I mention it merely to point out how easily void was assimilated to an insubstantial-seeming occupant of space, air. Even without this explicit evidence, it would be certain that at least one early conception of void was as something like thin air, for Anaxagoras, probably writing before the emergence of atomism, found it an adequate refutation of void (as understood by his contemporaries) to demonstrate the corporeality of air.² Absolute vacuum is something which falls right outside ordinary human experience, and we should not be surprised if it was at first insufficiently distinguished from the least substantial stuff familiar to the senses. Reflection on the English idiom 'vanish into thin air' may help confirm this.

I shall not suggest that Leucippus and Democritus are themselves to be saddled with a comparably primitive notion of vacuum. Their terminology, as we shall see, puts its entirely negative character beyond doubt. But insofar as their theory is likely to have evolved as a modification and refinement of earlier assumptions about vacuum, we should not be too surprised if we find them retaining at least some of their inherited conceptual framework. I shall maintain that the status of void as a space-occupier is an example of this.

It is widely recognised that the Eleatics Parmenides and Melissus had posed a challenge to the logical coherence of void, and that the atomists' achievement must be understood at least partly as a response to that challenge. Here too, then, we might hope to throw light on the atomistic conception of void, by asking precisely what it was that they were

attempting to rescue from the Eleatic elenchus. Unfortunately there is too little agreement on the interpretation of Parmenides' poem to make this a very promising proposal. I therefore confine myself to outlining one possible interpretation, one which sees a very direct Parmenidean ancestry for the atomistic dualism of body and void.

The job of cosmology was to reduce the world to the simplest possible set of constituent principles. Before Parmenides, cosmologists tended to count monism a virtue: if all phenomena could be reduced to manifestations of a single primal substance, the extreme of conceptual economy had been reached. Parmenides, whatever we take to be his own philosophical purpose, discredited monism as a cosmological theory by suggesting that no differentiations of any kind were possible in a world so conceived, because being, qua being, is entirely homogeneous. In the second half of his poem he went on to demonstrate that the minimum condition for the rehabilitation of cosmology was an unacceptable one, the introduction of a second element, homogeneous in itself but distinct from the first element. At least one reader, Aristotle,³ got the impression that there was some correspondence between these two elements and what Parmenides had in the Way of Truth called respectively 'being' (τὸ ἔόν) and 'not-being' (τὸ μὴ ἔόν). That supposition would, if nothing else, make good sense of Parmenides' rejection of cosmology as conceptually muddled, because not-being, he observed, does not exist. The atomists decided that they could work with a dualistic scheme such as Parmenides had hypothesised and rejected, by holding that not-being was not, after all, a self-refuting concept. Thus the atomistic universe consists, with enviable simplicity, of being and not-being. Of these, being, or 'the existent', is equated with body, not-being, or 'the non-existent', with void.

If there is any truth in this derivation of atomistic dualism from the dualism dismissively sketched by Parmenides in his Way of Seeming, its significance for present purposes is as follows. Parmenides' scheme was, quite properly, understood as a dualism of two *elements*. Hence anyone equating void with one of these elements should be predisposed to treat it as a movable entity capable of occupying whatever places are occupied by the compound objects of which it is part. Indeed, even if the Parmenidean ancestry should be doubted, there is sufficient independent evidence that the early atomists treated not only body but also void as an element (the word they would probably have actually used is 'principle', ἀρχή).⁴ The very clear and numerous reports to that effect might be suspected by some of forcing atomism into an ill-fitting doxographical straitjacket. But since Epicurus is in one report distinguished from his atomist predecessors on

this very point,⁵ there seems good reason to trust them.

Perhaps the strongest challenge to my interpretation of the atomists' vacuum will be based on Melissus. Did Melissus not argue that what exists is immobile because if it moved it would *move into void*, and void does not exist? Surely then, it will be argued, the Melissan challenge which the atomists were answering had already identified void as empty space.

In my view, this, the standard reading of Melissus 30 B 7.7-10, is mistaken.⁶ A translation will help to explain why.

(7) οὐδὲ κενεὸν ἐστὶν οὐδέν· τὸ γὰρ κενεὸν οὐδέν ἐστιν· οὐκ ἂν οὖν εἴη τὸ γε μηδέν. οὐδὲ κινεῖται ὑποχωρῆσαι γὰρ οὐκ ἔχει οὐδαμῆι, ἀλλὰ πλέων ἐστίν. εἰ μὲν γὰρ κενεὸν ἦν, ὑπεχώρει ἂν εἰς τὸ κενόν· κενοῦ δὲ μὴ ἐόντος οὐκ ἔχει ὀκνη ὑποχωρῆσαι. (8) πυκνὸν δὲ καὶ ἀραιὸν οὐκ ἂν εἴη. τὸ γὰρ ἀραιὸν οὐκ ἀνυστὸν πλέων εἶναι ὁμοίως τῷ πυκνῷ, ἀλλ' ἤδη τὸ ἀραιὸν γε κενεώτερον γίνεται τοῦ πυκνοῦ. (9) κρίσιν δὲ ταύτην χρῆ ποιήσασθαι τοῦ πλέω καὶ τοῦ μὴ πλέω· εἰ μὲν οὖν χωρεῖ τι ἢ εἰσδέχεται, οὐ πλέων· εἰ δὲ μῆτε χωρεῖ μῆτε εἰσδέχεται, πλέων. (10) ἀνάγκη τοίον πλέων εἶναι, εἰ κενὸν μὴ ἔστιν. εἰ τοίον πλέων ἐστίν, οὐ κινεῖται

(a) And nothing of it is empty. For what is empty is nothing. Well, what is nothing could not very well exist.⁷

(b) Nor does it move. For it cannot give way at any point, but is full. For if there were such a thing as empty it would give way into what was empty; but since there is not such thing as empty, it has no point at which to give way. (Dense and rare could not exist. For what is rare cannot be as full as what is dense, but what is rare already thereby becomes emptier than what is dense. And that is the criterion for distinguishing between what is full and what is not full. Hence if something gives way or accommodates, it is not full, but if it neither gives way nor accommodates, it is full.)

(c) [summary] So (a) it must be full, if there is no such thing as empty; and so (b) if it is full, it does not move.

The standard interpretation faces three objections. First, it must somehow construe ὑποχωρεῖν (and hence also χωρεῖν, which by a regular linguistic convention will retain the sense of the preceding compound form) as a simple verb of locomotion: hence the rather puzzled-sounding translation, 'it has nowhere to *retreat*' in 7. Second, it must ignore 8, on rare and dense, as an irrelevant intrusion. Third, it cannot easily explain why the immobility of what exists arises from *its* being full.

There is no need to imagine an external void into which what exists would transport itself. Why should Melissus concern himself about anything external, given his demonstration that what exists has no boundaries? What he is denying is an internal *admixture* of void, which would make what exists rare or spongy and thus enable it to 'give way' (ὑποχωρεῖν) at some point. For according to 8-9 the 'empty' is characterised by rareness, the signs of which are ability to give way and absorbency. His claim, then, is

that the non-existence of void makes what exists *internally* immobile – more like a stack of bricks than a sponge. Void is envisaged as that which must be mixed in with a substance to make it less than totally dense. And that, as far as I can see, is at least as compatible with the ‘emptiness’ interpretation as with ‘empty space’.

3. *The early atomists*

Aristotle in his discussion of void in *Physics IV* several times (e.g. 213b 31) asserts that the proponents of void regard it as unoccupied place; and both he in the fragments of his work *On Democritus* (fr. 208 Rose) and Simplicius in his commentary on the *Physics*⁸ attribute the same view to Democritus by name. But on closer inspection this evidence crumbles. Simplicius’ attribution is derived from Aristotle’s, and is therefore not independent evidence. And Aristotle’s assertion is itself of dubious value. It suits him to treat void as place, because he has already defined place in such a way as to deprive it of independent existence, and he now seizes the opportunity to tar void with the same brush (especially 214a16-22). But elsewhere (215a11) he is just as happy to treat void instead as a kind of negative substance (μη ὄν τι), or privation, where this will afford him a further ground of refutation.⁹

I therefore conclude that Aristotle’s evidence on this question is of little historical value,¹⁰ and I prefer to settle the matter by relying on our one secure item of evidence, the atomists’ own nomenclature for void. Three interchangeable pairs of terms were adopted for the twin principles of atomism, body and void. These are ‘the existent and the non-existent’ (τὸ ὄν καὶ τὸ μὴ ὄν), ‘the thing and the nothing’ (τὸ δὲν καὶ τὸ μηδέν), and ‘the full and the empty’ (τὸ πλήρες καὶ τὸ κενόν). The first two pairs of terms – ‘the thing and the nothing’, and ‘the existent and the non-existent’ – can only be understood as designations of that which occupies space. To call empty space itself ‘nothing’ or ‘non-existent’ would indeed be to deny that there is such a thing. But to call the *occupant* of a pocket of space ‘nothing’ or ‘non-existent’ would be to assert on the contrary that there is such a thing as empty space; and that is what the atomists wanted to assert. And the symmetrical looking pairing of τὸ πλήρες and τὸ κενόν suggests that if τὸ κενόν is empty space then τὸ πλήρες is filled space; but τὸ πλήρες is in fact identified with atoms, and if an atom is a filled space it will become extremely hard to see how it can move. So there is every reason to expect τὸ κενόν too to designate not empty space but the negative substance which occupies empty space.

It may be felt that in that case the atomists were unwise to hypostatise this mysterious negative occupant of space. Epicurus seems to have thought so, as we will see in the next section. But for the time being I shall stick to showing the enormous advantage which it conferred on their system. By making both of their primary elements occupants of space they were able to make them into formal contradictories. It seems clear enough that the three pairs of terms were chosen with this object in mind. Every point in space is either occupied or unoccupied. If it is occupied, it is occupied by something, *δέν*; if it is unoccupied, it is occupied by nothing, *μηδέν*. If it is occupied by something, that thing is existent, and can be called 'fullness' (*τὸ πλήρες*); if it is occupied by nothing, its occupant is non-existent, and can be called 'emptiness' (*τὸ κενόν*). So by relying on the plausible and widespread assumption that to exist is to occupy a place, the atomists could comfortably sit back and allow any existing thing, i.e. any occupant of place, to sort itself out into one or other of their pair of contradictory elements or into a complex of the two. The Law of the Excluded Middle would ensure that nothing escaped classification under the scheme. By selecting as elements a pair of formal contradictories they came up with an ontological scheme of the utmost elegance and economy. All that would have been jeopardized if only one of the elements had been an occupant of place while the other had been a species of place itself.

It may be objected that the scheme as I propose to interpret it is in danger of hypostatizing place as a third kind of existing thing. I do not myself feel that the danger is, historically speaking, a real one. The interpretation does not require that any theorising about the nature or status of place should have been done. I have tried to show that, given their conceptual background, the view of vacuum as a quasi-substance and place-occupier was simply the natural assumption for the atomists to make. Besides, even if they had faced up to the challenge, they would probably have thought it ill-conceived. The body-void dualism was their answer to the question 'What is there in the universe?', and any candidate for this role would be assumed to exist in a place. To make the same demand of place itself would be to initiate an infinite regress – as their contemporary Zeno of Elea mischievously tried to do.¹¹ Questions about the status of place, as also that of time, are higher-order metaphysical questions which should be thought no more pertinent to the cosmological system of the atomists than to those of Anaxagoras and Empedocles.

Of course it is well known that Leucippus and Democritus bought this scheme at a price; the price of declaring that the non-existent exists (*τὸ μὴ ὄν εἶναι*), or, on an alternative version, that the nothing (*τὸ μηδέν*) exists.¹²

These paradoxical slogans are the legacy of the Eleatics, whose argument against void was precisely that, being the nothing and the non-existent, it did not exist. But how did the atomists think they could get away with such a bare-faced self-contradiction? How can they have supposed that by announcing that the non-existent exists they were doing anything more than reassert the Eleatic refutation of void?

One type of solution takes it as a purely humorous *ad hominem* move. The slogan is most commonly cited in the form 'The existent no more exists than the non-existent', but Democritus is also reported to have expressed it as 'The thing (τὸ δέν) no more exists than the nothing (τὸ μηδέν)'. This latter formulation could be thought to have a rhetorical force: 'You deny that τὸ μηδέν exists, but actually its contradictory, τὸ δέν, sounds if anything more problematic'. On this interpretation δέν would be a humorous coinage like 'couth' or 'ept', invented to embarrass an opponent. But even if the word is likely to have been an unfamiliar one to Democritus' readers,¹³ it is so regularly listed along with his other designations of body and void that it is hard to doubt that it was one of his own technical terms. He and Leucippus were, arguably, the first philosophers to develop a technical terminology. It is tempting to connect this fact in turn with one of his four arguments for the non-natural character of language, the νόνημον argument,¹⁴ which rests on the observation that there are some things in the world for which language has failed to supply a name: τὸ δέν could be meant as an example of a missing name.

Often a 'no more' (οὐ μᾶλλον) clause behaves as a self-evident premiss for some argument: no more (i.e. 'there is no more reason for it to be the case that . . .') p than q; but p: therefore q. This is, for example, how the atomists argued that since there is a world here there must be worlds elsewhere, by asking what more reason there was for the one to be true than the other.¹⁵ But 'the existent no more exists than the non-existent' could hardly function in that way. On the face of it, there is far more reason for the existent to exist than the non-existent. The paradox must, therefore, have received some theoretical defence.

Jonathan Barnes has recently proposed the much more promising suggestion that we understand 'The non-existent exists' in terms of the Fregean distinction between 'x exists' in the sense of 'x is a real thing', and 'x exists' in the sense of 'there is x'. By 'the non-existent' the atomists intended the first of these two senses, i.e. 'that which is unreal'. By saying of this that it 'exists' they meant '*There is* that which is unreal' — a perfectly intelligible claim, which a non-platonist might, for example, make with reference to numbers.

I have two worries about this. First, why should the atomists want to call void 'unreal'? Barnes takes this conclusion to follow from the premisses (1) that to be real is to be a space-filler and (2) that void is not a space-filler. I hope I have already shown reason to doubt the second of these premisses. Void *is* a space-filler. At least, it occupies some parts of space just as effectively as body occupies others. Moreover, if the atomists had regarded void as unreal it would be hard to understand why they gave it the status of an element alongside body, or what Democritus meant by his celebrated declaration, 'By convention there is colour, by convention sweet, by convention bitter, but in reality (ἐρεῆ) atoms and void'¹⁷ – odd language for someone who considers void unreal.

There is a second objection. Now the distinction which Barnes attributes to Democritus is more or less the one which the Stoics were later to make. Void for them is not one of τὰ ὄντα, real existent things, because only bodies 'exist'. Void only 'subsists' (ὑφίσταται), which means roughly 'there is such a thing as' void. But it would be hopelessly anachronistic to expect Leucippus or Democritus to have expressed any such distinction – not merely, that is, to have isolated the existential sense of the verb 'to be' but also to have found two distinct shades of meaning within it. Barnes, to be fair, admits this, and suggests only that the atomists were 'feeling towards such an insight'. But that would hardly be enough. In declaring that the non-existent exists they were blatantly inviting ridicule, unless they had a defence prepared. If this particular insight is one which they were no more than feeling towards, they needed some other insight there and then to offer to their opponents.

Democritus did, it is true, recognise that some words have more than one meaning. But I know of no evidence that he, or anyone else until a much later date, put this insight to work on the solution of philosophical problems. What comparable device can we attribute to him without anachronism? I can only think of one: the move of explaining that something is true *in one respect but not in another*. This can be illustrated from Leucippus' contemporary Empedocles, who thought he could evade the Eleatic ban on change by making all cosmic change strictly cyclical (B 26, 8-12):

Thus insofar as (ἤν μὲν) one has learnt to come into being out of many, and when one disintegrates many are formed, to that extent they are becoming and have no stable life. But insofar as (ἤν δὲ) these things never cease from their continual change, to that extent they are for ever unmoved in a circle.

I see no reason why Democritus should not have answered the Eleatic ban on void by a similar tactic, defending the paradox that the non-existent

exists by explaining that in one respect void exists but that in another it does not. In what respects? Let us assume once again the equation of 'exist' with 'occupy a place'. The atomists could then say that when a place is occupied by nothing, insofar as the occupant is nothing it does not exist, but insofar as it occupies a place it does exist.

4. Epicurus

For Epicurus' conception of void the principal text is *Ep. Hdt.* 39-40:—

1. ἀλλὰ μὴν καὶ τὸ πᾶν ἔστι <σώματα καὶ κενόν>. σώματα μὲν γὰρ ὡς ἔστιν αὐτὴ ἡ αἰσθησις ἐπὶ πάντων μαρτυρεῖ, καθ' ἣν ἀναγκαῖον τὸ ἔδηλον τῷ λογισμῷ τεκμαίρεσθαι ὥσπερ προεῖπον. τόπος δὲ εἰ μὴ ἦν, ὃν κενὸν καὶ χώραν καὶ ἀναφή φύσιν ὀνομάζομεν, οὐκ ἂν εἶχε τὰ σώματα ὅπου ἦν οὐδὲ δι' οὐ ἐκινεῖτο, καθάπερ φαίνεται κινούμενα. παρὰ δὲ ταῦτα οὐθὲν οὐδ' ἐπινοηθῆναι δύναται οὔτε περιληπτῶς οὔτε ἀναλόγως τοῖς περιληπτοῖς ὡς καθ' ὅλας φύσεις λαμβανόμενα, καὶ μὴ ὡς τὰ τούτων συμπτώματα ἢ συμβεβηκότα λεγόμενα.

1. <σώματα καὶ κενόν> Gassendi: <σώματα καὶ τόπος> Usener 3. ὥσπερ προεῖπον τὸ πρόσθεν· εἰ μὴ ἦν ὃν (δ B² (TD) Z³ f Φ) κενὸν κτλ. B² P Co FZ¹: ὥσπερ προεῖπον τὸ πρόσθε εἰ μὴ ἦν ὃν κενὸν κτλ. B¹: ὥσπερ προεῖπον. τόπος δὲ εἰ μὴ ἦν, ὃν κενὸν κτλ. emendavit Usener: ὥσπερ προεῖπον τὸ πρόσθεν. εἰ <δὲ> μὴ ἦν δ κενὸν κτλ. alii. 5. οὐδ' Usener οὔτε Ω

Moreover, the totality of things is <bodies and void>. That bodies exist is universally attested by sensation itself, in accordance with which it is necessary to judge by reason that which is non-evident, as I said above; and if place, which we call 'void', 'room' and 'intangible substance', did not exist, bodies would not have anywhere to be or to move through as they are observed to move. Beyond these nothing can even be thought of, either by imagination or by analogy with what is imagined, as things grasped in terms of complete substances and not as what we call accidents or properties of these.

There are two crucial emendations to the text, and I must start with a defence of them. Fortunately we have a check on this text in a very closely parallel passage of Lucretius, 1.419-428. The opening sentence is hopeless as it stands, and the supplement <σώματα καὶ κενόν> is the obvious one to adopt, both because the same formula is attested for Epicurus in other sources¹⁸ and because it corresponds exactly to Lucretius' *corpora sunt et inane* at the equivalent point in his version (1.420). The second emendation, in 3, is more controversial. Usener's brilliant conjecture, which I have adopted, has been virtually ignored by editors this century. Most have preferred to follow Gassendi in retaining ὥσπερ προεῖπον τὸ

πρόσθεν as the end of one sentence, and in adding a connective in the next sentence, to make εἰ <δὲ> μὴ ἦν ὁ κενόν ---. Usener ends the first sentence at προεῖπον, and emends τὸ πρόσθεν to τόπος δὲ, retaining ὄν with the best mss. in place of ὄ. Several considerations favour this. First, τὸ πρόσθεν is disturbingly redundant with προεῖπον, especially where the reference is only to the previous paragraph; so an emendation which gets rid of it is welcome. Second, Usener's text requires only two letters to be changed in the original reading of the best ms., the Borbonicus (the reading of B *ante correctionem* is from my own autopsy of the codex – Usener did not realise quite how strongly it supported him). The alternative emendation requires four letters in B's original reading to be changed. Third, the resultant reading corresponds much more closely to the equivalent clause in Lucretius (1.426-7), 'Then again, if there were not place and room, which we call void'; the alternative reading leaves nothing in Epicurus' text to correspond to Lucretius' *locus*.

Why have all these advantages been overlooked? Perhaps it is because Usener's text seems to make void and place straight synonyms, and editors have hesitated to introduce such an obvious howler into Epicurus' text by way of an emendation. The answer to this is twofold.

First, with or without the emendation the very same conflation of void with place is implicit at the end of the same sentence: '(Without void) bodies would not have anywhere *to be* or to move through, as they are observed to move'. Void provides stable location as well as passage. Giussani and Bailey try to mitigate the confusion by observing that strictly speaking there are no stable locations in Epicurean physics, because atoms are in perpetual motion.¹⁹ But this will not do. The laws of atomic motion cannot be assumed at this early stage in Epicurus' argument, because they themselves follow upon the proof of void. Besides, the last three words of the sentence make it clear that Epicurus has not atoms but phenomenal bodies in mind; and these can be said to have stable location. Moreover, the same treatment of void as place recurs at *Ep. Hdt.* 42 and several times in Lucretius.

Second, *is* this conflation of place with void a howler? Those who believe so might be tempted to argue that τόπος, occupied space, can hardly be regarded as a second constituent of the universe on a par with the bodies which occupy it, whereas the void intervals between those bodies clearly might be. It is for the controversial void intervals that Epicurus should be arguing, and that is a quite separate task from that of arguing for the existence of occupied place, which no opponent would have denied. Although these difficulties are real ones, I want to argue in what follows

that there is no simple oversight or confusion on Epicurus' part, but a doctrine evolved to cope with conceptual difficulties first raised by Aristotle and still kept alive by sceptics in the Hellenistic era.

The story, as I reconstruct it, starts with Aristotle's criticisms of the notion of void. I have already suggested that Leucippus and Democritus considered void an occupant of place rather than a species of place itself, but that Aristotle for reasons of his own tended to attribute the latter view to them. This assumption allows him to raise a fundamental conceptual difficulty (*Physics* IV, 213a15-19):—

Those who speak of void set it up like a sort of place and vessel. They think that it is full whenever it contains the mass which it is fitted to receive, but void whenever it is deprived of it — as if void and plenum and place are all the same thing yet their essence is different.

This description is meant to introduce the notion of void for discussion, not as an argument against it. But it is clearly a loaded description, and it helps soften us up for the formal refutation of void which follows at 216a26-b16:—

Also considered in itself the alleged void would appear to be a truly empty notion. For just as, if someone puts a cube in water, water equal in volume to the cube will be displaced, the same happens in air, only it is imperceptible to the senses. Indeed, it is always the case with every body capable of displacement that it must, unless compressed, be displaced in its natural direction of displacement, always either downwards, if its movement is downwards like that of earth, or upwards, if it is fire, or in both directions, whatever sort of thing be inserted in it. But in the void this is impossible, since it is not a body, but the cube must be penetrated by an extension equal to that which previously existed in the void — just as if the water, or air, were not displaced by the wooden cube but completely penetrated it.

But the cube has a magnitude equal to the void it occupies, and this, although it is hot or cold or heavy or light, is different in respect of being from all its attributes, even if not separable from them: I mean the volume of the wooden cube. So if it could actually be separated from all the other attributes, and be neither heavy nor light, it will occupy an equal void and be in the same place as the portion of place or void equal to itself. What then will be the difference between the body of the cube and the equal void or place? And if there will be two such things in the same place, why not any number of things? This is one absurd and impossible consequence. And again, it is clear that the cube will even when it is displaced have this thing which all other bodies have too, so that if it is no different from the place why should we make a place for bodies over and above each one's volume (if the volume is something without attributes)? It contributes nothing to suppose such a distinct equal extension belonging to it.

The crucial question raised here is what happens to void when a body enters it? The first stage of the argument is the important part for our purposes. The void cannot be displaced by the body, because it is not itself

a body, and we are expected to agree that the only sort of thing which a body can displace is another body. Therefore the void must remain and become completely coextensive with the body. Aristotle does not consider the possibility that on being filled the void perishes, perhaps assuming, with some justification, that the atomists would not have bought their way out of trouble at the price of making one of their two primary elements perishable.

The absurdity of a void coextensive with a body might have been thought a sufficient refutation of the void theory. Aristotle's own approach, however, is to suppose that the void will survive in the guise of the body's *place*. But this conception of place as the interval or extension filled by a body is one he has already rebutted (211b14-29), and the second stage of the present argument is really, I think, just a reinforcement of that rebuttal. If this extension which the body comes to fill is something distinct from the body's own volume, then we will be landed with two indistinguishable things in the same place; and if two, then why not any number? Aristotle can only maintain this line of argument by ignoring his own earlier demonstration that strictly speaking a place cannot itself be in a place. I doubt if it impressed his readers very much, and I find every reason to think that it was the first stage of the argument taken on its own that caused most perplexity to the champions of void.

To see what sort of dilemma (or, more accurately, trilemma) Aristotle's argument posed for Epicurus, it will be helpful to look at it in a later Hellenistic formulation, as presented by Sextus Empiricus (*M* 10.20-3). Of course, this actual formulation postdates Epicurus, and is probably aimed in the first instance at the Stoic concept of place. But it is of interest both because it sets out fairly starkly the choice which Epicurus had faced, and also because it could well represent a continuing tradition of criticism inspired by the *Physics* IV argument (the immediately following arguments, *M* 10.24-36, can be seen to draw heavily on the material in *Physics* IV):—

For if there exists any body-housing place, it is either body or void. Now, the body-housing place is not body; for if every body must be in a place, and place is body, the place will be in a place, and that place in a third place, the third in a fourth, and so on *ad infinitum*. Therefore the body-housing place is not a body. But if the body-housing place is void, then when the body arrives at it either this void remains, or it is displaced, or it is destroyed. And if when the body arrives at it it remains, it will be simultaneously void and full, void insofar as it remains, full insofar as it houses the body. But it is unthinkable to call the same thing both void and full. Therefore the void does not remain when the body arrives at it. But if the void is displaced, the void will be body; for that which is displaced from here to there is

body. But the void is not body. Therefore it is not displaced either, when the body arrives at it. Besides, if it is displaced when the body arrives at it, it will no longer be housing the body, and that too is absurd. It remains therefore to say that the void is destroyed, which is again impossible. For if it is destroyed it undergoes change and movement; and if it is destroyed it is generable. But the generable and destructible thing which undergoes change and movement is body. Therefore the void does not perish either. Thus if place is neither body, as we have proved, nor void, as we have pointed out, no place can exist.

With these arguments in mind, let us consider what possible responses Epicurus could offer to Aristotle's conundrum, what happens to void when it is approached by a body? Plato had proposed the law that anything which is approached by its own opposite must either withdraw or perish (*Phaedo* 102dff.). And on another occasion Epicurus was happy to agree. I deduce this from one of Lucretius' arguments against Empedocles' four-element theory (1.760-2), where it is observed that some of these elements are mutually opposed; therefore when they approach each other they must either perish or dodge each other. But in the case of void neither alternative was very palatable. Take the first alternative, that void withdraws on the approach of body. Sextus echoes Aristotle in commenting that only a body can be displaced. Epicurus would have to agree with this, since he rightly holds that void, unlike body, cannot act or be acted on (*Ep. Hdt.* 67). The second alternative, that it perishes, looks no more promising. Sextus' argument is that perishing involves change and movement, of which only body is capable. But I would not expect that to convince Epicurus, if only because he holds that, strictly speaking, even body does not perish, but only undergoes redistribution. The reason why he cannot contemplate the possibility of void's perishing is that his entire system is founded on the familiar principle that the universe will be unstable and unintelligible unless its ultimate constituents are permanent ones; and these constituents are body and void.

If neither alternative is acceptable, the only available move short of abandoning void altogether is to allow that void does after all remain when a body enters it. But the only way in which it could coexist with a body would be by becoming that body's *place*. Hence Epicurus has no choice but to follow Aristotle's lead in conflating void with place. Democritus' conception of void as a negative substance would no longer do, since that could in no way be imagined as existing in the same place as body. How Epicurus handled this conflation is admirably explained by Sextus Empiricus in a passage (*M* 10.2) which, extraordinarily, has been almost totally neglected by modern scholars when discussing the Epicurean theory of void:—

Therefore one must grasp that, according to Epicurus, of 'intangible substance', as he calls it, some is named 'void', some 'place', and some 'room', the names varying according to the different ways of looking at it, since the same substance when empty of all body is called 'void', when occupied by a body is named 'place', and when bodies roam through it becomes 'room'. But generically it is called 'intangible substance' in Epicurus' school, since it lacks resistant touch.

Epicurus invents the technical expression 'intangible substance' for space in its broadest sense, whether occupied or unoccupied. He then explains the familiar words 'void', 'place' and 'room' as being merely the terms by which we refer to it in specific contexts: 'void' when it is unoccupied, 'place' when it is occupied, and 'room' when bodies move through it (this last definition is backed up by an etymological association of χώρα, 'room', with χωρεῖν, 'go', which I here translate 'roam'). All three terms name the same thing, intangible extension. When bodies pass into and out of this, it remains unaffected in all but name. As Aetius puts it (1.20.2 = fr.271 Usener),

Epicurus says that the difference between void, place and room is one of name.

It may be asked why he should call place, i.e. occupied space, an intangible substance. Presumably the justification would be that it is not the space itself which is tangible, but the body occupying it – when the body moves out of it the space itself will not offer it any resistance. At any rate, a very similar view was held, according to Simplicius, by the majority of the Platonists and Strato of Lampsacus (fr.60 Wehrli). These people spoke of space as in its own nature a void coextensive with the cosmos, but in practice always filled with body. Epicurus' 'intangible substance' may have a strong claim to be the first clear recognition of geometrical space as a three-dimensional extension which persists whether or not it is occupied by body. But if anyone arrived at the same notion before him,²¹ it is these Platonists of whom Simplicius speaks, working no doubt from Plato's notoriously problematic depiction of space in the *Timaeus*. Epicurus' first philosophical training was in Platonism, and it may be that we would understand the origins of his theory of space better if we knew more about the work of men like Xenocrates.

To return to *Ep. Hdt.* 40, I understand Epicurus' wording "place", which we call "void", "room" and "intangible substance", as an announcement that he will use its various names indifferently, probably in order to emphasize that the difference between them is one of context, not of essence. True to his word, he does elsewhere fluctuate in his usage between 'void', 'place' and 'intangible substance' without apparent dis-

inction, although 'void' is certainly his favourite. It may seem odd that he puts 'place' first, rather than the master concept 'intangible substance'. The object is no doubt strategic: place is the least controversial of the four terms.

The range of alternative names also serves to stress that at least some parts of space are occupied and at least some unoccupied. And this is confirmed by his proofs of its existence: (a) it is needed to provide location, i.e. there must be occupied space; (b) it is needed to allow motion, i.e. there must be unoccupied space into which things can move.

I therefore conclude that *Ep. Hdt.* 40 is not muddled, but represents a coherent doctrine evolved in response to Aristotle's criticism of the notion of vacuum.

As a result of this shift of position, Epicurus has jeopardised the symmetrical antithesis of body and void which had been such a merit of the early atomists' system. There is now none of Democritus' pairs of contradictory terms which Epicurus can use. 'Thing and nothing', and 'the existent and the non-existent' are unsuitable, not only because they are semantically puzzling but also because they are, as we saw, names for occupants of space, not for space itself. As for 'the full and the empty', now that 'the empty' means empty *space* 'the full' would inevitably imply 'full space', which is not a suitable definition of an atom. (When Epicurus uses πλήρης it is as a predicate not of body *per se* but of those portions of body which contain no void gaps (*Ep. Hdt.* 41, 42).) He does, however, have another pair of contradictories which characterise body and void respectively, and these are 'tangible' and 'intangible'. He never uses them in Democritean fashion as the *names* of body and void, but he appeals to them to show that body and void themselves are true contradictories. The relevant argument is preserved by Lucretius (1.430-439):—

Praeterea nil est quod possis dicere ab omni corpore seiunctum secretumque esse ab inani, quod quasi tertia sit numero natura reperta. nam quodcumque erit, esse aliquid debebit id ipsum augmine vel grandi vel parvo denique, dum sit.	430
cui si tactus erit quamvis levis exiguusque, corporis augebit numerum summamque sequetur; sin intactile erit, nulla de parte quod ullam rem prohibere queat per se transire meantem, scilicet hoc id erit, vacuum quod inane vocamus.	435

Beyond these there is nothing which you can call distinct from all body and separate from void, to play the role of a third discovered substance. For whatever will exist will have to be in itself something with extension, whether large or small, so long as

it exists. If it has tangibility, however light and faint, it will extend the measure of a body and be added to its sum. Whereas if it is intangible, and unable to prevent anything from moving through it at any point, it will undoubtedly be the emptiness which we call void.

Most editors transpose lines 434 and 435, but I have retained the ms. order and taken *augmine* (434) to mean 'extension'.²² This gives Lucretius a vital premiss: 'Whatever will exist will have to be in itself something with extension, whether large or small, so long as it exists'. Presumably this means 'three-dimensional extension'. The premiss looks like one used by Zeno of Elea (29 B 2 D.-K.), that something without magnitude could not exist because when added to something else it could not increase that thing's size. With this premiss established Lucretius can safely proceed to a dilemma: either this extended thing is tangible or it is intangible. If it is tangible it will, when added to a quantity of body, increase it. The implicit conclusion is that it must then itself be body, and this follows provided that we assume a further premiss, that if a quantity of body is increased by addition that which has been added to it is itself body. The argument continues: if on the other hand the extended thing in question is intangible, being unable to resist moving bodies it will allow them to pass straight through — precisely the essential function of void. It will be seen now that the premiss that only spatially extended things exist is a necessary one — otherwise all sorts of impostors might get included under the heading 'intangible', even Platonic Forms.

So the antithesis of 'tangible' and 'intangible' comes to the rescue and seems to make Epicurus' 'body and void' a neatly symmetrical pair of contradictories, as they had been for Leucippus and Democritus. But underneath the definitional symmetry there now lurks a strong ontological asymmetry. Body and space are in some sense joint constituents of the world, yet many parts of space are completely occupied by body. This is not in itself an absurdity: the Stoic principles, matter and God, also coincide spatially, as do body and mind in the view of many philosophers. Even so, I think Epicurus was perfectly well aware that void as he conceived it was of a very different order of being from body. He resisted the temptation to follow Leucippus and Democritus in calling it an element, and used that name for atoms alone (*Ep. Pyth.* 86).²³ He never makes the mistake of regarding a compound body as made out of atoms and void in combination. The void of the early atomists, being a substance housed in space, could presumably be an element of a compound body and move around with it; but once Epicurus had identified void with place, it became stationary and no longer available as an element of movable compound

bodies. Compound bodies consist of atoms variously spaced out. Space provides the location of these atoms, the intervals between them, and room for them to move; but it is not itself part of the compounds.

Why then does Epicurus pair body and void in the formula 'the totality of things is bodies and void'? He does not mean by this that the universe is compounded out of them in the way that a house is compounded out of bricks and mortar. Rather, he means that they are the only two orders of being that are required to account for the universe. All other candidates for the title 'existent', including time, events and properties, can be accounted for as attributes of body, incapable of separate existence (Lucretius 1.449-82). Space alone cannot. And that is because it exists even where body does not.²⁴

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¹ Aristotle, *Physics* IV 213b22-7. In defence of an early date for this doctrine, see C. H. Kahn, 'Pythagorean philosophy before Plato', in A. P. D. Mourelatos (ed.), *The Presocratics* (1974).

² 59 A 68 Diels-Kranz. No doubt the argument was, like 59 B 17, phrased as a criticism of current usage in general, not just of a specific doctrine.

³ *Metaphysics* I 986b27-987a2.

⁴ According to Eudemus, fr. 31 Wehrli, στοιχεῖον in the sense 'element' was first used by Plato.

⁵ Aetius, *Plac.* 1.3.14-18, p. 285 Diels, *Doxographi Graeci* (1879). Cf. frs. 173, 184, 188-9, 190, 192, 194, 262, 264, 487 in S. R. Luria, *Demokrit* (Leningrad 1970).

⁶ Cf. G. Reale, *Melisso, testimonianze e frammenti* (1970), 176-92, for a survey of current interpretations, and add J. Barnes, *The Presocratic Philosophers* (1979) I 217-9. Some of the weaknesses which I point out in the standard type of interpretation have already been discerned by Reale, Barnes, P. Albertelli (*Gli Eleati, testimonianze e frammenti* (1939)), J. Loenen (*Parmenides, Melissus, Gorgias* (1959)), and others.

⁷ The real subject of the first sentence is 'it' (what exists), as comparison with the closing sentence shows. The first οὐδέν must therefore be adverbial. But my translation is designed to bring out the word play of the first two clauses. οὐκ . . . οὖν . . . γε is the negation of γοῦν, so that the οὖν has no inferential force: see J. D. Denniston, *The Greek Particles* (ed. 2, 1954), 422-5, and Loenen, *op.cit.*, 163-4.

⁸ E.g. Simplicius *In Ar. Phys.* 394,25 ff., 397,2 ff. (= fr. 250 Luria), 571,22 ff. (= fr. 254 Luria). Aristotle's influence may also explain Eudemus' tendency to treat early views of void in the same way: cf. Eudemus fr. 75 Wehrli on Democritus (= fr. 251 Luria), and fr. 65 on Archytas (= 47 A 24 Diels-Kranz); and note 21 below.

⁹ Cf. *Met.* I, 985b4 ff. (= fr. 173 Luria), where the atomists' void is not 'place' but an element, characterised as μανόν; *De caelo* 302a1 ff., where void is thought of as occupying a place; and *ib.* 309b17 ff., where one of the possibilities considered is that void would be capable of locomotion.

¹⁰ The likelihood that Aristotle's depiction of void as place is unhistorical is well noted by F. Solmsen in *Aristotle's System of the Physical World* (1960) 140-2. It is certainly not my

purpose to question Aristotle's integrity in the matter. For one thing the view of void which I attribute to the atomists is more likely to have been an assumption than a worked-out theory for which chapter and verse could be cited. For another, they no doubt also had occasion to speak of empty places, and for all I can show to the contrary they may have misleadingly used τὸ κενόν of these as well. My point is that the cardinal notion of void, as featured in their dualism of atoms and void, cannot be of empty space. *Met.* I, 985b4 ff. (see previous note) suggests that Aristotle may have appreciated this.

¹¹ 29 A 24 Diels-Kranz.

¹² E.g. frs. 78, 173, 194, 261 Luria.

¹³ See Loenen, *op. cit.*, 79, and A. C. Moorhouse, 'ΔΕΝ in classical Greek', *CQ* n.s. 12 (1962), 235-8. The form is rare, but is found as early as Alcaeus, 320. L.-P., and still in Theodotion's Old Testament translation, *ap. Philop. De opif.* ii 1.59.12. For attributions of it to Democritus as a regular term, see frs. 78, 172, 185, 188 Luria.

¹⁴ Fr. 563 Luria

¹⁵ Fr. 1 Luria; cf. frs. 2-8, and Barnes, *op. cit.*, II, 251-7.

¹⁶ Barnes, *op. cit.*, II 100-3. I have learnt a great deal from this marvellous book, and would not want my disagreement on this issue to obscure that fact.

¹⁷ Fr. 55 Luria.

¹⁸ Usener's <σώματα καὶ τόπος> has had an undeservedly bad press. The same formula occurs at fr. 76 Usener and *Nat.* 34.14.7-9 Arrighetti, and is suggested by σώματα μὲν . . . τόπος δὲ in what follows (on the reading see below). But Gassendi's <σώματα καὶ κενόν> also has good parallels in frs. 74-5 Usener, in addition to Lucretius' support.

¹⁹ C. Giussani, *Studi Lucreziani* (1896), 25; C. Bailey, *Lucretius, de rerum natura libri sex* (1947), II 653; cf. Brad Inwood, 'The origin of Epicurus' concept of void', *CP* 76 (1981), 273-85, p. 280-1. The Democritean thesis that the only 'real' truths are truths about atoms and void, never about phenomenal objects, is regularly assumed to be shared by Epicurus. I argue against the assumption in 'Epicurus' Refutation of Determinism' in G. Pugliese Carratelli (ed.), *Συζήτησις* Naples, 1983).

²⁰ This text has been consistently overlooked because Usener included it only in the addenda to his *Epicurus* (1887): fr. 271, pp. 350-1. It is now discussed by Inwood (art. cit. 281-2), who dismisses it as Stoic-contaminated. This, however, could only be established if it were shown to be at variance with Epicurus' theory, and my own view is that on the contrary it makes excellent sense of it. I see no conflict between saying that void, place and room differ accidentally, or according to different ways of looking at the same thing (ἐπιβολάς — a very Epicurean term: cf. *Ep. Hdt.* 70 for just this usage), and saying that they are all names for the same thing, as at *Ep. Hdt.* 40 and fr. 271 Usener (cited below): one might, for example, describe the relationship of the Morning Star to the Evening Star in both ways without inconsistency. And Inwood's other objections are, I believe, adequately met by what I say in the main body of this paper. Only one item of evidence needs explaining away. At 1.503-6 Lucretius suggests that body and space cannot be coextensive. This is technically incorrect, on the account which I adopt. But note that Lucretius quickly corrects this to *empty* space (1.507-9). Inwood's interpretation, on which Epicurean void comes out looking rather like Democritean void as I have interpreted it, conflicts with at least three items of evidence (art. cit., 280-1) as well as with Epicurus' principle that void cannot be acted upon (*Ep. Hdt.* 67).

²¹ The same notion of container space may already be implicit in Archytas 47 A 24 Diels-Kranz, as reported by Eudemos, although it is hard to judge how far the conception

of τόπος there may reflect Eudemus' Aristotelian understanding of void (see note 8 above).

²² In this I am following Brieger's 1894 Teubner edition, although he emends *aliquid* (433) to *aliquo*, perhaps rightly.

²³ Cf. Aetius, cited note 5 above.

²⁴ Versions of this paper were read to meetings at London, Princeton, Stanford and Chicago. I benefited from the discussions on all four occasions, and owe particular thanks to Myles Burnyeat, John Cooper, Rick McKim, Henry Mendell, Brad Inwood, Ian Mueller and Elizabeth Asmis for their comments and suggestions. Above all, it is to Brad Inwood's paper (cited note 19 above) and to our extended correspondence about it, that I owe the impetus to write on this subject. The reader can be safely referred to it for a wider-ranging discussion and fuller bibliography than I have provided here. It is a far richer paper than my foregoing criticisms may suggest, and its demonstration that Epicurus read *Physics* IV closely (pp. 282-4) is so powerful that I have felt able to take this for granted in my own paper. Finally, for the leisure to write this final version of the paper I am deeply indebted to the Humanities Council of Princeton University for the award of a visiting fellowship in the Fall Semester 1981-2, and to the Institute for Advanced Study, Princeton, for membership during the second term of that year.