

# Space and Subtle Matter in Descartes's Metaphysics

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## 1. Space as extended nothing

Descartes's views about matter and space are more interesting, instructive, and problematic than has been generally realized, as I shall try to show in this paper. Let us start with his famous denial that there can be vacuum, or empty space:

It is a contradiction to suppose there is such a thing as a vacuum, i.e. that in which there is nothing whatsoever. The impossibility of a vacuum, in the philosophical sense of that in which there is no substance whatsoever, is clear. . . . A body's being extended in length, breadth and depth in itself warrants the conclusion that it is a substance, since it is a complete contradiction that a particular extension should belong to nothing; and the same conclusion must be drawn with respect to a space that is supposed to be a vacuum, namely that since there is extension in it, there must necessarily be substance in it as well.<sup>1</sup>

Two things are going on here: one straightforward, the

other not. Straightforwardly, Descartes is rejecting vacuum when it is understood as extended nothing, an instance of extension that does not consist in some thing's being extended.

The idea of vacuum as bulky nothing is fit to be rejected, but who has ever had it? Is not Descartes here tilting at a windmill? He thinks not. He writes, of something believed to be 'an empty space', that 'almost everyone is convinced that this amounts to nothing at all'.<sup>2</sup> Elsewhere he makes a more fine-grained accusation: 'People judge that so-called empty space is nothing; all the same they conceive it as a positive reality.'<sup>3</sup> I like Descartes's subtle distinction between what people judge and how they conceive or represent things, but I shall not linger with it now. My concern is with the allegedly common opinion that space is extended nothing.

Surprisingly, there is a basis for this allegation. Descartes took care to reject that view of space because it had a place on the historical stage. I learn from Copleston that Leucippus, while holding that space is as real as body, referred to it as 'what is not' and to body as 'what is'.<sup>4</sup> Similar views were

<sup>1</sup> *Principles* 2:16; CSM 1, 229f.

<sup>2</sup> *Principles* 2:5, CSM 1,225.

<sup>3</sup> Letter in 1641 to Hyperaspistes; CSMK 194.

<sup>4</sup> F. C. Copleston, *A History of Philosophy*, vol. 1 (London: Burns Oates and Washbourne, 1950), p. 73.

mentioned by Aristotle and held by a number of medieval philosophers.<sup>1</sup> Echoes of this way of thinking linger on even today. After discussing early ideas about space purely in terms of ‘emptiness’, Daniel Garber abruptly says: ‘Aristotle, of course, would have none of this nothingness. . .’.<sup>2</sup> This unheralded switch from emptiness to nothingness links Garber with the ancients and medievals whom Descartes was attacking.

Although Descartes is not making an historical mistake in thinking he needs to refute the thesis that space is a bulky nothing, he is philosophically wrong in thinking that this refutation is all he needs to establish his own view of space. There are two other lines for a non-Cartesian metaphysician of space to take; I shall discuss one in Sections 2–3 and the other in Section 6.

## 2. Container space

In *Principles* 2:16 Descartes notes that a body’s being extended entails that it is a substance;<sup>3</sup> he generalizes this to the claim that anything’s being extended entails that it is a substance; and then he purports to apply this to space. The natural way of applying it would be with this argument:

- Whatever is extended is a substance.
- Every region of space is extended.
- So every region of space is a substance.

That is not what Descartes says, however. He argues instead like this:

- Whatever is extended is a substance.
- Every region of space has extension in it.
- So every region of space has a substance in it.

If the first premise of that is equivalent to ‘Wherever there is extension there is a substance’, then the argument looks valid; but its second premise is mysterious. What can it be for something to have extension in it? (i) It has been suggested to me that it means ‘Wherever there is a region of space, there is extension’. What a bizarre meaning for that sentence! Anyway, the conclusion it yields is merely ‘Wherever there is a region of space there is substance’, which is untouched by the notion of a-substance-in-it, which is my present topic. (ii) The second premise might mean that any region of space has extension in-it-as-subject, which is just to say that it is extended. That is a recognized way of speaking;<sup>4</sup> properties are often said to be ‘in’ the things that have them; and Descartes’s second premise on that reading of it is true. But those two premises yield only the conclusion that every region of space is a substance—not ‘has a substance in it’, which is the conclusion of Descartes’s that we want to understand. I conclude that Descartes reaches his thesis that every region of space has a substance in it through an argument which is plainly invalid or else has a perfectly obscure second premise.

In Section 4 below I shall discuss what Descartes is up to in *Principles* 2:16. First, though, I present a metaphysics of space according to which regions of space can, strictly

<sup>1</sup> For examples, see Edward Grant, *Much Ado about Nothing: Theories of Space and Vacuum in the Middle Ages to the Scientific Revolution* (Cambridge University Press, 1981), p. 73.

<sup>2</sup> Daniel Garber, *Descartes’s Metaphysical Physics* (University of Chicago Press, 1992), p. 127. The present work grew out of a conference paper that I expressed as a series of criticisms of Garber’s treatment of these matters. His responses to those criticisms have helped me to improve my own treatment, and I owe him further thanks for comment on a draft of this paper.

<sup>3</sup> Or replace ‘a substance’ throughout by ‘substance’. The difference between the mass and count uses of ‘substance’, though often important, does not affect any issues discussed here.

<sup>4</sup> Descartes uses it in section 2 of ‘Comments on a Certain Broadsheet’, CSM 1. 294f.

and literally, have substances in them—the regions being things or substances that have other substances in them. This is the theory that space is a container, an extended thing or substance whose parts (regions) can be colocated with or penetrated by extended substances of a different kind, namely bodies. If there is a pebble at a certain place, according to this metaphysic, there are two things there: the pebble and a portion or region of container space.

(Do not mix this with the peculiar way in which an object is sometimes said to be colocated with the portion of stuff of which it is composed. The new ring on my finger now coincides in space with an old portion of gold, from which some philosophers have inferred that these are distinct things which at present are colocated. Even if they are right, this differs from the colocation that container space involves. When a body is colocated with a region of such space, the two can part company: the body can move while the region stays, both continuing to stay in existence. My ring could not come apart from the gold that now constitutes it, with both remaining intact.)

If there is container space, it might all be full, so that nature is a plenum; or some might be empty, so that there are stretches of vacuum. Which of those obtains would be a contingent matter. Now, Descartes holds that there is matter everywhere, but nobody has ever credited him with holding that there is container space which is all full. He speaks of ‘spaces’ as ‘full’ rather than ‘empty’, and as having bodies ‘in’ them—we have just seen one example of this—and I shall explain that in Section 4. But it is perfectly clear that Descartes was no friend of container space.

Why? What did he have against it? Well, it might be thought to be ruled out by his doctrine that whatever

is extended must be corporeal. (I shall call this doctrine **Extension**, for short.) Descartes seems to claim that he has argued against container space—or at least against empty container space—in that manner: ‘In *Principles* 2:18 I said expressly that I think the existence of a vacuum involves a contradiction, because we have the same idea of matter as we have of space.’<sup>1</sup> In *Principles* 2:11 he explicitly says that we have the same idea of matter as we have of space; perhaps there and in 2:18 he can be seen as inferring from this that the existence of a vacuum involves a contradiction, though the argument is somewhat muffled. Anyway, let us consider the strength of this argument, whatever its status in the text.

If we demand Extension’s credentials, Descartes has not much to say. His only argument for it, the discussion of the piece of wax in the Second Meditation, is not exact and scrupulous enough to support such a strong conclusion. But he has powerful reasons for wanting Extension to be true: its truth would mean that the basic concepts of physics are just those of geometry, together with the concept of time; and Descartes saw this as giving physics conceptually clear foundations which would be threatened if we had also to admit, on the ground floor, some further concept such as that of force or mass. His physics failed, primarily because he tried to construct it with too few basic concepts; but the fact remains that he was indissolubly wedded to Extension, so that we are entitled to put it into play when trying to understand why he rejected container space.

Is it much of a reason? Well, it is so if we assume that container space would have to be extended and incorporeal. ‘Portions of container space could not be bodies’—to your ears and mine that sounds right, but only because we do not

<sup>1</sup> Letter to the Marquess of Newcastle (1645), CSMK 275.

accept Extension. If we did accept it, that would free us to allow that container space is one kind of matter or body. Why should we shrink from calling it 'body' if all we meant was that it is extended? If we adopt that option, however, we must allow that bodies can be colocated with other bodies—e.g. pebbles with regions of container space. Is there anything wrong with that? Aristotle thought so: If two bodies could be colocated, he said, then all bodies could be colocated, in which case the entire world of matter would shrink to the size of a grain of wheat. This argument was offered against the thesis that any two extended items could be colocated, and in that form it was destroyed in the 6th century by John Philoponus who pointed out that bodies might be colocatable with regions though not with other bodies. He held that space is not substantial (an extended nothing?), but that is not needed for his rebuttal of Aristotle. It seems not to have been involved when the same rebuttal was re-discovered and more clearly presented by Hasdai Crescas eight centuries later.<sup>1</sup> Both philosophers were relying, however, on the idea that extended items fall into two radically different kinds, with collocation possible between the kinds but not within either. The natural way to express this is:

Extended items are of two kinds, bodies and regions of container space. There can be collocation between the kinds but not within either.

We shall not word it like that, though, because we are going along with Descartes's resolve to describe everything extended as 'corporeal'. Still, we can stand against Aristotle's argument by saying instead:

Extended items (bodies) are of two kinds. There can be collocation between the kinds but not within either, and the difference between this formulation and the other

may be merely verbal. If Descartes took this line, though, he would have to say more. Specifically, he would need to declare whether this difference between the two kinds of body is fundamental or derived; and each answer would be problematic for him. If the difference is basic, Descartes's physics loses its unity and conceptual spareness, for it now needs not only geometrical concepts and the concept of time but also the concept of what distinguishes the two basic kinds of body. If on the other hand the difference is derivative, supervening on differences involving only geometrical and temporal concepts, Descartes ought to tell us how this is so, as he tries to do with heat and colour; and that is a patently hopeless task.

So perhaps we have here a reason why Descartes might keep container space at bay. We can, in the quick and shallow way of most of the secondary literature on this topic, express it as a simple appeal to Extension: container space would be extended and incorporeal; Extension says that what is extended must be corporeal, therefore and so on. Getting deeper into it, the reason is this: If there were container space with which (other) bodies could be colocated, either collocation could run riot as threatened by Aristotle or else there must be two fundamentally different kinds of extended substance, with collocation possible between them but not within each; and such a difference spells death for Descartes's biggest single ambition for his physics.

### **3. Another reason for rejecting container space?**

Descartes had a different and plainer reason for rejecting container space, embodied in an argument which rules it out by concluding that no extended item can penetrate, i.e. be colocated with, any other:

<sup>1</sup> I take this history from Grant, *Much Ado about Nothing*, pp. 19f, 22.

It is impossible to conceive of one part of an extended thing penetrating another equal part except by understanding that half of that extension is taken away or annihilated; but what is annihilated does not penetrate anything else; and so, in my opinion, it is established that impenetrability belongs to the essence of extension and not to that of anything else.<sup>1</sup>

Notice that Extension is not involved in this argument, which says nothing about the extended items' being bodies. The argument concerns any pair of extended things—two bodies, two regions of space, or one of each. A little later, indeed, Descartes uses the argument to rule out More's suggestion that one part of space might be colocated with another.<sup>2</sup> I cannot find him applying it to a space-body pair, but he ought—and I think he would—be willing to do so. The quoted argument, if sound, shows that there cannot be container space, since that would involve the possibility that one extended thing (a body) should be colocated with another extended thing (a region of space). Call the second extended thing a 'body' too, if you like; but that has no effect on the argument, which owes nothing to Extension.

Garber reconstructs this 'simple and ingenious' argument thus: 'If a body is an extended thing, in the sense in which Descartes understands it, then take away extension and you take away body. But if two bodies could penetrate one another, then the total volume, and thus some amount of body itself, would be eliminated.'<sup>3</sup> The confinement to 'bodies' is unwarranted, but otherwise Garber clearly has it right. That clears the air, enabling us to see that the argument begs the question so openly as to be worthless. It assumes

that the physical fusion of a body with volume  $V_1$  and a body with volume  $V_2$  must be a body with volume  $(V_1 + V_2)$ ; but that is equivalent to assuming that there is no colocation. If bodies can interpenetrate then it might be that one body has  $V_1$  while another has  $V_2$  though the two together occupy a total volume of less than  $(V_1 + V_2)$ ; neither has lost any volume, but a part of one is colocated with a part of the other. Here is an analogue. Let the volume of a sound be that of the region throughout which it is audible; then it can happen that the shriek of a fire alarm has a volume of 550,000 cubic yards and the boom of an explosion one of 780,000 cubic yards, yet their combined volume is only a million cubic yards because throughout much of the city both are audible.

#### 4. Spaces and places

Within a container-space metaphysic one can correctly describe regions of space as 'empty' or 'full', or as having bodies 'in' them. For a region to have a body in it, in this metaphysic, is for all or part of the region to be colocated with a body. On no other basis is it strictly correct to speak of regions as either full or empty. Yet many of Descartes's commentators credit him with holding that no region of space is empty because all are full. He certainly does hold that there is matter everywhere—there's no doubt about that—but that is different from saying that matter completely fills something or other.

Descartes is partly to blame for this common misstatement of his position. We have already seen him writing of a space as having a body 'in' it, and such turns of phrase occur often in his writings. Still, he does not believe that

<sup>1</sup> Letter to More (1649), CSMK 372. I learned about this argument from Garber's book. Like Garber, I assume throughout that Descartes's 'penetration' is exactly what I call 'colocation'.

<sup>2</sup> See also Letter to [Unknown] (1645), CSMK 252.

<sup>3</sup> Garber, *Descartes's Metaphysics*, p. 147.

there is anything which the world's matter fills—there's no doubt about that either—so we have something to explain. Why does Descartes apparently mis-express his own views by writing of 'spaces' as 'full' and 'empty'?

I say 'apparently' because there must be more going on than appears on the surface. Whatever it is must also explain Descartes's writing this: 'The subtle matter around a candle moves in a circle, and tends to spread out from there and to leave an empty space, that is to say, a space which would be filled only by what might come into it from elsewhere.'<sup>1</sup> The original French makes it even clearer than does the CSM version that Descartes is saying only that the subtle matter *tends* to do this, not that it actually succeeds; but still the passage on the face of it tolerates the notion of container space. It is not credible that Descartes meant to do that; so something else must be going on. First I shall introduce a certain distinction in my own terms, then argue that Descartes was also employing it in a manner which helps to explain these puzzling passages.

We need to distinguish a (*region of*) *space* from a *place or location*. A place, in my sense of that word, is abstract: it is a complex relational property, and thus differs *toto coelo* from a region of space. It is indeed a relational property that a region can have, just as a body may have it. If a body is colocated with a region of container space, then those two items have the very same place, that is, they are related in the same way to other bodies. It is vital to get clear about this concept of the *where* of a thing—its set of spatial relations to other things. When I use the word 'place' it will be only to express that concept; that is one proper use of it, and whether it can also be acceptably used to mean the same as 'region' does not matter.

Using 'place' in this sense, it would be safer to say that bodies are 'at' places rather than 'in' them, because the latter suggests containment, which invites confusion between places and regions. Still, we can rescue the 'in' idiom by understanding a body's being 'in' a place as being its possession of a certain relational property—just as we have a sense for 'He is in a bad mood' which does not imply that he inhabits the mood or that it contains him. With the concept of place in hand, let us look again at Descartes's extraordinary phrase 'an empty space, that is to say, a space which would be filled only by what might come into it from elsewhere'. Beneath the vexatious empty/full terminology, I suggest, Descartes is entertaining a thought about *a place*.

WHAT DESCARTES SAYS	WHAT HE MEANS
<b>The subtle matter tends to move in such a way as to</b>	
move out of a region	lose a certain relational property
	<b>which would</b>
remain empty	no longer be possessed by anything
	<b>unless bodies from elsewhere</b>
moved into it	came to possess it.

This is still counterfactual: it says only how the matter tends to move, meaning how it would move if. . . And I do not know how Descartes could make sense of the concept of a place-defining relational property that is once owned by something and later by nothing. But at least Descartes on this reading is not entertaining the thought of container space, which he so often declares to be absolutely, conceptually impossible.

<sup>1</sup> Letter of 1639 to Mersenne, CSMK 138.

In that passage, if I am right about it, Descartes is thinking of places while writing purely in terms of full/empty and ‘spaces’ (regions of space). Elsewhere, however, he employs the ‘place’ terminology. At the start of *Principles* 2:17 he uses the phrase ‘place or space’ and then treats it as equivalent to ‘place’. In 2:19 he alludes disparagingly to the common view that (parts of) ‘space’ can be ‘empty’, and then in 2:33 he reports that in 2:18–19 he has said ‘that every place is full of bodies’. These turns of phrase provide some support for my conjecture—if, but only if, Descartes in them means ‘place’ in the sense I have given it.

The best evidence that he does mean it like that occurs in *Principles* 2:10–15. These sections run ‘place’ and ‘space’ in a single harness but treat them as a pair. Descartes differentiates them in several ways, most notably thus:

There is no real distinction between space, or internal place, and the corporeal substance contained in it; the only difference lies in how we are accustomed to conceive of them. For the extension in length, breadth and depth which constitutes a space is in reality exactly the same as that which constitutes a body. The difference arises as follows: in the case of a body, we regard the extension as something particular, and thus think of it as changing whenever there is a new body; but in the case of a space, we attribute to the extension only a generic unity, so that when a new body comes to occupy the space, the extension of the space is reckoned not to change but to remain one and the same, so long as it retains the same size and shape and keeps the same position relative to certain external bodies which we use to determine the space in question.<sup>1</sup>

The best way to understand this obscure passage, I submit, is by supposing that what Descartes is calling ‘space or internal place’ is a complex relational property that may be possessed first by one body and then by another. That enables it to be true that first one body and then a different one is ‘in’ (better: ‘at’) a certain place, without there having to be some thing which literally contains first one and then the other.

I offer this proposal as a way of rescuing the things Descartes says about spaces and places. Still, he cannot have had this thought in a clear, explicit and controlled manner, because he thought of places as being extended. Places (in my sense, the sense relevant to Descartes) are not extended; complex relational properties do not have length, breadth and depth. You might think that an item with no shape or size cannot contain bodies, but I remind you that places—in my sense—do not contain bodies. The ‘body in place’ locutions that we freely use are an idiom which divorces ‘in’ from all such notions as that of containment.

## 5. Bodies as adjectival on space

John O’Leary-Hawthorne has suggested to me the following interpretation of Descartes’s talk of ‘empty’ and ‘full’ and so on. Descartes might think that for there to be a pebble at a given place (in my sense of ‘place’) is for there to be at that place a pebbly region of space. If a suitably constrained region of spatio-temporal zones is pebbly throughout, then we can describe that as a single pebble moving through space; and that makes it idiomatically all right to distinguish a region from a pebble that is ‘in’ it. But really, strictly, there are only the regions of space that are sometimes pebbly and sometimes not; so that there is never a ‘real distinction’ between any pebble and any region, because that would be a

<sup>1</sup> *Principles* 2:10, CSM 227.

distinction between things, and at the metaphysically basic level there are no such *things* as pebbles. We often say that there are; and this is idiomatic, convenient, and intelligible; but still it is only a shallow *façon de parler* which is, taken deeply and strictly, false. When we talk about pebbles that move, we do or ought to mean something about alterations in which regions are pebbly and which are not.

One way of handling the golden ring which I mentioned early in Section 2 is to say that strictly speaking there is only the portion of gold; it is idiomatically all right to say that there is a ring now, because the gold is annular now; but a metaphysically deep inventory of the world's contents would include the portion of gold but not the ring. That is analogous to the suggested treatment of space and objects: a region's being sometimes pebbly and sometimes not is comparable with a portion of gold's being sometimes annular and sometimes not.

This view about bodies and space has been espoused by Plato, Newton, Spinoza, and some physicists in our own century. I ascribe it to Spinoza on the strength of many things in his *Ethics*—notably the doctrine that there is only one extended substance, of which finite bodies are 'modes'. Taking 'mode' in its standard 17th century sense, that means that finite bodies are states of the one extended substance, are adjectival upon it, relating to it as blushes do to faces. That implies that for there to be 'a pebble in a region' is for the region to be pebbly, and that a pebble's movement through space is basically not the movement of a thing but rather an alteration in which regions are pebbly and which are not, comparable with the movement of thaw across a countryside.<sup>1</sup> (The strongest rival to my reading of Spinoza's monism about extended substance is

Curley's, which is based on the premise—not independently defended—that Spinoza meant by 'mode' less than half of what was commonly meant by it at his time.<sup>2</sup>)

The case for this reading of Spinoza is strong; but Descartes's writings do not so well support an outright attribution of the same view of space and bodies to him. Just once, in the Synopsis to the *Meditations*, he seems to suggest that there is only one extended substance, which one naturally thinks of as the whole of space (CSM 2, p. 10); but even that is not clear and straightforward, and nowhere does Descartes hint that finite bodies are adjectival upon space or the one extended substance. Perhaps he was starting to flirt with or move a little towards the Spinozist metaphysic of space and body, but I submit that he did not get close enough for it to affect much what he thought or wrote.

For my main purposes in this paper, however, it does not matter which way we choose to rescue what Descartes says about spaces as 'full' and 'empty'. What does matter is to grasp firmly the fact that, although he frequently speaks of spaces/places as having bodies 'in' them, there is no item of which Descartes believes that it can literally contain bodies. The humdrum sense in which a flask can contain tea is irrelevant to our topic. It involves one body's merely surrounding another; Descartes would never say about the flask and the contained tea, as he does about the space or place and the body 'in' it, that 'there is no real distinction' between them.

## 6. Space as a system of relations

Descartes gave short shrift to container space, but he dismissed another time-hallowed metaphysic of space as though he had never even heard of it. I shall approach it through his

<sup>1</sup> For details see Jonathan Bennett, *A Study of Spinoza's Ethics* (Indianapolis, Hackett, 1984), chap. 4.

<sup>2</sup> Edwin Curley, *Spinoza's Metaphysics: an Essay in Interpretation* (Cambridge, Mass., Harvard University Press, 1969.)



attempt to ‘correct our preconceived opinion about absolute vacuum’ through this argument:

If someone asks what would happen if God were to take away every single body contained in a jar, without allowing any other body to take the place of what had been removed, the answer must be that the sides of the jar would in that case have to be in contact. For when there is nothing between two bodies they must necessarily touch each other. And it is a manifest contradiction for them to be apart, or to have a distance between them, when the distance in question is nothing; for every distance is a mode of extension, and therefore cannot exist without an extended substance.<sup>1</sup>

This argument deserves patient scrutiny. Descartes challenges us with the question: ‘What is there between the opposite sides of the jar?’ He warns us against answering ‘Only a distance’: distances are modes, he says, meaning that they are adjectival upon things. You cannot have a sheer five inches between two things: it must be some third thing that measures five inches along one of its dimensions. ‘It is a complete contradiction that a particular extension should belong to nothing’, we have seen Descartes saying; and he is right. This belongs to his proper denial that space could be a bulky nothing.

What is there between the sides of the jar after the air has been removed? Here is another possible answer: ‘Before God took action, there were two jar-shaped and -sized things in there—a portion of matter and a region of space—and after he had removed the matter the space remained.’ That is the container-space answer, and Descartes here offers no reason to reject it. All that he actually argues for is that

the two non-contiguous sides of the jar must have some ‘extended substance’ between them; but the conclusion he has announced is that the two sides must have some other ‘body’ between them. This involves not merely a superficial verbal point but also, as we have seen, a deeper issue about colocation.

My topic in this section is a third possible answer to the question ‘What is there between the opposite sides of the jar?’. It goes as follows. If when God removes the matter from the jar it does not collapse, then it follows that the opposite sides of the jar are apart. Now, Descartes assumes that if

(i) Side  $S_1$  is apart from side  $S_2$ ,

that must be because

(ii) Some thing is between  $S_1$  and  $S_2$ .

That is, the obtaining of the seemingly dyadic fact about apartness must be an upshot of a triadic fact about betweenness. That snubs the possibility that (i) is a *basic* fact about how the two things are related, not one made true by an underlying fact about how the two relate to a third thing. That view was later endorsed by Leibniz in his famous correspondence with Clarke; it was also implicit in some earlier theories of space, but perhaps not clearly enough. At any rate, Descartes does not so much as hint at it.

I call this the theory that space is a system (or structure) of relations. Some other phrases might characterize it more aptly, e.g. as the view that there is no space, and that all our spatial concepts are concepts of spatial relations amongst bodies. But I need something brief, and shall stay with what I have chosen.

Descartes might challenge the Leibnizian:

*If there is nothing between two things, they are contiguous.* That is so trivially obvious that someone

<sup>1</sup> *Principles* 2:18, CSM 1, 231.

who denies it does not deserve to be heard. And it entails, by contraposition, that if two things are not contiguous there is something between them.

The Leibnizian should reply that the ‘trivially obvious’ thesis is false when taken strictly and philosophically; and that it seems undeniable only when taken in a loose, colloquial fashion in which ‘There is nothing between them’ merely *means* that they are contiguous.

Be warned: the relational view of space, which Descartes ignored and Leibniz defended, should not be confused with a relational view of *place*. Here is Locke taking a relational view of place:

That our idea of place is nothing else but such a relative position of any thing. . . is plain. . . when we consider that we can have no idea of the place of the universe, though we can of all the parts of it; because beyond that we have not the idea of any fixed, distinct, particular beings in reference to which we can imagine it to have any relation of distance; but all beyond it is one uniform space or expansion, wherein the mind finds no variety, no marks.<sup>1</sup>

Our notion of the place of any body, Locke holds, must be a notion of how it is spatially related to other bodies. To cash it out instead in terms of which portion of space the body is in we need a notion—not parasitic on bodies—of the separate identities of different portions of space; and we cannot have that, because space is all ‘uniform’.

Now this view of place is not, for Locke, a down-payment on the theory that spatial concepts generally must be reduced to relational ones, i.e. that space is a structure of relations. He is carefully agnostic about that theory;<sup>2</sup> and

his working picture of space seems to view it as a substantial container some parts of which are colocated with bodies.

My point is philosophical: Someone who holds (i) that our only concept of place is a relational one is still free to affirm or to deny (ii) that space is not a thing but a system of relations. When Locke, having accepted (i), suspended judgment on (ii), this was an impeccable performance. Similarly for Descartes, who also accepted an odd version of (i) and silently turned his back on (ii).

### 7. The fourth view: space is a separator

We have looked at Descartes’s treatment or neglect of three views:

- space is a bulky nothing, (Section 1)
- space is a substantial container, (2–4)
- space is a structure of relations. (6)

Descartes puts much energy into denying the first; his rejection of the second is silent, but there are reasons for it in his work; and he seems to ignore the third without giving or having good reasons for or against it. He does accept the much weaker thesis that our actual concept of place is relational, but that does not commit him to relationalism about spatial concepts generally.

We should consider just one other possible view, namely that space is a separator, relating to bodies as water does to fish swimming in it. Water does not relate to fish in the ‘container’ manner: no fish is colocated with any portion of water; rather, a fish swims among the portions of water, pushing them aside as it moves; fish and water compete for places. The portions of water, rather than ‘containing’ the fish in my sense, surround the fish and separate them from

<sup>1</sup> *Essay* II.xiii.10.

<sup>2</sup> ‘Whether any one will take space to be only a relation resulting from the existence of other things at a distance, or whether. . . [etc.] I leave every one to consider’ (*Essay* II.xiii.26).

one another. The separator metaphysic is analogous to that: there are regions of space and there are bodies, and the two kinds jointly exhaust all the locations there are; but no two particulars have the same position at the same time. Where body starts, space stops; just as where fish starts, water stops.

Portions of separator space would be, in Descartes's terminology, portions of matter; they would be bodies. He distinguishes portions of matter as more or less 'subtle', less or more 'dense'; and the items I have been calling regions of separator space are what he would call portions of absolutely subtle matter—bodies which can be divided and brushed aside by fish, pebbles, feathers and so on without these being deflected, slowed down, or otherwise impeded. In what follows, I shall sometimes call separator space 'absolutely subtle matter'; the phrase without that adverb will refer to all matter that is well out towards that end of the scale.

All portions of matter are movable, including portions of absolutely subtle matter. Also, none can be colocated with anything else; so all are perfectly impenetrable, and thus are solid. What marks off absolutely subtle matter from the rest is that it has no inertial resistance to being moved, so that no force is needed for any portion of it to be pushed aside by a portion of less subtle matter. Thus, you could not feel some absolutely subtle matter by swishing your hand through it, as you can feel pond water. You feel the water because it resists as your hand dislodges it, which absolutely subtle matter would not. Still, if we could arrange for your hand to be a piston moving into a cylinder containing absolutely subtle matter, with your hand fitting so perfectly that the

matter could not escape between your hand and the piston wall; and if neither the piston wall nor your hand had fissures through which the absolutely subtle matter could leak away; then that matter—that portion of separator space—would be tangible to you, obdurately stopping your hand's motion into the piston and feeling, presumably, like steel.

Does Descartes allow that there is, or even that there might be, absolutely subtle matter? Sometimes he seems to stop short of that, apparently suggesting that any portion of subtle matter would, if studied minutely enough, be found to have properties of dense matter. He speaks of our careless tendency to think we have found empty space when confronted by regions in which 'we do not perceive anything by sight, touch or any other sense',<sup>1</sup> and criticizes the supposition 'that a space we call empty contains not just nothing perceivable by the senses but nothing whatsoever'.<sup>2</sup> If Descartes is here referring strictly to the unaided senses, excluding what might be learned through artifice, he may be assuming that each apparently empty region would show up as granulated, striated, or the like through powerful enough microscopes, or would impede the movement of other bodies by an amount that could be detected by sensitive enough measuring instruments.

He does not outright say that, however, and sometimes he seems to deny it. He comments on what we are apt to say 'if we understand there to be nothing in a given place but extension in length, breadth and depth', apparently allowing that what 'we understand' may be correct.<sup>3</sup> He explicitly declares to be 'intelligible' the idea of 'bodies which in no way hinder or assist the motion of other bodies.'<sup>4</sup>

<sup>1</sup> *Rules* 12; CSM 1, 48. See also *The World* 4; CSM 1, 87; and *Meditation* 6, CSM 2, 56.

<sup>2</sup> *Principles* 2:17; CSM 1, 230.

<sup>3</sup> *Principles* 2:5; CSM 1, 225.

<sup>4</sup> *Principles* 4:21; CSM 1, 268f.

He makes assertions about what happens when ‘a body moves through a space containing only matter which neither speeds it up nor slows it down.’<sup>1</sup> He writes that ‘what is commonly called empty space is. . . a real body deprived of all its accidents’, which he explains as meaning that the body is deprived of every property except determinates of extension.<sup>2</sup> In passages like those, Descartes seems to countenance extended items which will not affect sense-organs or scientific instruments—ones whose existence as *things* depends purely upon their geometrical properties together with abstract metaphysical argument against the notion of extended nothing.

### 8. Smallness of parts

It seems, therefore, that Descartes does not rule out there being portions of absolutely subtle matter, ‘bodies’ lacking density, inertia, resistance, and any other properties through which they could be detected other than their merely geometrical ones of size, shape and location. In the remaining four sections of this paper I shall consider whether his metaphysic permits this tolerance. Is Descartes entitled, on his own principles, to think that there could be absolutely subtle matter? He cannot accept that absolutely subtle matter differs in a *basic* way from matter that is somewhat dense. If he allowed two fundamentally different kinds of matter, his physics would lose its unity and its conceptual parsimony—the features he most prized in it. However, Descartes openly

holds that some bodies are subtler than others, ranging all portions of matter on a long subtler/denser continuum; and for him this difference is not basic but derivative, like that between warmer and colder. Let us ask how Descartes explains this derived continuum, looking for an answer that could carry over to the absolutely ‘subtle’ end of the scale. If we find one, then Descartes is free to believe in separator space.

One determinant of subtleness, Descartes holds, is smallness of parts. He contrasts ‘some very subtle and very fluid matter’ with ‘the less fluid or coarser parts of the air’, and this opposition between ‘subtle’ and ‘coarse’ indicates that subtleness depends on size of parts.<sup>3</sup> In later work, having introduced a theory about spherical particles which are his ‘second element’, Descartes proceeds to introduce his ‘first element’, which he characterizes in the Latin version of the work as ‘other more subtle matter’ and in the French as ‘other more tiny particles’.<sup>4</sup> The link between subtleness and smallness of parts comes to the surface later:

We have. . . two very different kinds of matter which can be said to be the first two elements of this visible universe. The first element is made up of matter which is so violently agitated that when it meets other bodies it is divided into particles of indefinite smallness. . . The second is composed of matter divided into spherical particles which are still very minute when compared with those that we can see with our eyes,

<sup>1</sup> Letter to More; AT II, 442. I learned of this passage from Garber. Could Descartes mean that (B) the moving body is not modified by (M) the matter it moves through because M gets out of B’s way and thus doesn’t collide with it? (If so, Descartes is not implying that M is so subtle that it does not affect B in a collision.) We shall see later that Descartes does try the ‘evasion’ ploy, but that is a strained and insensitive reading of the present passage, and I mention it only because it has been suggested to me.

<sup>2</sup> Letter in 1649 to More; CSMK 381.

<sup>3</sup> *Optics* 1; CSM 1, 154.

<sup>4</sup> *Principles* 3:49; CSM 1, 258.

<sup>1</sup> *Principles* 3:52; CSM 1, 256.

but which have a definite fixed quantity and can be divided into other much smaller particles.<sup>1</sup>

That subtle matter is finely divided is made clear elsewhere too.

To make sense of the idea that bodies might differ in how small their parts are, Descartes must tread delicately. For him all matter is indefinitely divisible, not merely geometrically but physically: *any* portion of matter, he holds, can be split into sub-portions.<sup>2</sup> Every portion is made up of indefinitely small 'parts' in this sense; so part-size cannot differentiate subtle matter from dense. To get further with this approach, Descartes needs a different concept of 'part'—let us say '*discriminated* part'—in terms of which bodies can differ in the sizes of their (discriminated) parts. It is the same concept that is needed when Descartes writes: 'All the bodies in the universe are composed of one and the same matter, which is divisible into indefinitely many parts, and is actually divided into a large number of parts which move in different directions.'<sup>3</sup> So a portion of matter may be divisible into parts into which it is not actually divided [*reipsa divisam*]. What can Descartes mean by that?

For many metaphysicians, a discriminated part would be a physical part surrounded by (i) some empty container space or (ii) separator space. Descartes rejects (i) altogether. If he invoked (ii) to get differences of part-size, Descartes could not then use the latter as a basis for differences of subtleness, for that would make the whole procedure circular. Setting those two aside, then, what concept of discriminated part, or of actual division, is Descartes entitled to have en route to an account of subtleness?

Well, he clearly implies that if two portions of matter differ in the sizes of their discriminated parts, that must result from how the internal movements of one differ from those in the other:

The matter existing in the entire universe is. . . one and the same, and it is always recognized as matter simply in virtue of its being extended. All the properties which we clearly perceive in it are reducible to the sole fact that it is divisible [*partibilis*] and that its parts can be moved, and its resulting capacity to be affected in all the ways which we perceive as being derivable from the movement of the parts. . . Any variation in matter or diversity in its many forms depends on motion.<sup>4</sup>

That incidentally kills one plausible idea about how Descartes might explain discriminated parts, namely with help from qualitative differences between portions of matter. Thus: if a corporeal sphere has a core which is all F, surrounded by a shell none of which is F, then that core is a discriminated part of that sphere. But the quoted passage rules that out as a basic explanation, by implying that F/not-F differences in matter are never basic and must always supervene on differences in movements.

The quoted passage and others like it entail that the concept of discriminated part must be analysed in terms of propositions about how portions of matter move. Although that conclusion does not emerge clearly in Descartes's writings, I think he saw and accepted it. I base this on his frequent conjoining of two ideas: that subtle matter is finely divided, and that its parts move rapidly relative to one another. I have cited one example ('smaller and faster

<sup>2</sup> In *Principles* 2:34, Descartes supports this with an argument that Leibniz rightly called 'beautiful'.

<sup>3</sup> Pr 3:46; CSM 1, 256.

<sup>4</sup> *Principles* 2:23; CSM 1, 232. CSM puts 'are reducible to its divisibility and consequent mobility in respect of its parts'. The word 'consequent', though Cartesian in its effect, has no basis in the Latin.

moving') and we shall encounter others shortly. All I want at present is the sheer fact of relative motion of the parts; speed will come into play further down the line.

One might well object: 'How can relative motions of parts help? Anything Descartes might say about how the (discriminated) parts of subtle matter move requires him already to have a concept of such parts; and that was our question. Your supposed "clue" to solving our problem presupposes that it has already been solved.' Well, I think that when Descartes talks about relative motions he is partly trying, albeit inexplicitly, to explain what discriminated parts are.

I shall give this explanation more openly than he does, using a mild technicality: A portion of matter is *internally static*, I shall say, if there is no relative motion within it, all its sub-portions being in motion (or at rest) together in a block. The view that I think Descartes ought to take, and unclearly does take, is that a physical (=geometrical) part P of a body is a discriminated part of it just in case:

- (a) P is internally static, and
- (b) P is not a physical part of any larger internally static portion of matter.

On this account, the discriminated parts of any portion of matter are its largest internally static physical (= geometrical) parts. We can also now explain what it is for a portion of matter to be 'actually divided': a particle is divided if some physical parts of it are moving relative to others; if all its physical parts are moving together but could begin to move relative to one another, the particle is undivided but divisible.<sup>1</sup>

<sup>1</sup> That is pretty much how Spinoza understood Descartes. 'Matter that moves in various ways has at least as many parts into which it is actually divided as the different degrees of speed that are observed in it at the same time.' (Spinoza, *Descartes's Principles of Philosophy* 2, axiom 16.) I suppose he says '*at least* as many' because there may be differences that are not observed.

<sup>2</sup> Leibniz, 'On Nature itself' 13, in the Ariew-Garber collection at pp. 163f.

(I am setting aside a more acute difficulty confronting Descartes. He maintains that all qualitative variety in the extended realm supervenes on differences in how portions of extended substance move; but that cannot be right if this is: *Any contentful notion of differences in how items move presupposes qualitative differences between them.* That was Leibniz's view; and I think that his arguments were good and their conclusion correct.<sup>2</sup> This is the deepest level at which Descartes's parsimonious physics fails. It is a fascinating topic of philosophical inquiry, but I have enough on my plate without it.)

## 9. Subtleness and size

Once he has in hand the account of discriminated parts that I have presented, Descartes might say that the subtleness of any portion of matter depends solely on how small its discriminated parts are, i.e. on the size of its largest internally static physical parts. Then the question 'Is there any limit to how subtle matter can be?' is equivalent to 'Is there any limit to how small can be the largest internally static physical parts of a portion of matter?' Descartes's answer is negative: there is no limit to this. We have already seen him saying that matter of the first element 'is divided into particles of indefinite smallness'. On that view of subtleness, he has no reason to limit how subtle matter can be; so he has no grounds for denying that there is separator space, i.e. matter which offers no resistance to being pushed around by other matter.

Is that Descartes's view about what subtleness consists in? Some texts favor Yes, others No, but I can find no

decisive evidence for either answer. Except for one thing that Descartes writes: 'I conceive of subtle matter as a continuous liquid occupying all the spaces not taken up by other bodies, and not as something composed of disconnected parts such as the particles that make up dust.'<sup>1</sup> That ought to mean that all subtle matter is actually divided into parts that are indefinitely small; from which it follows that part-size cannot be what differentiates fairly from absolutely subtle matter. But I am not convinced that that is considered doctrine rather than an occasional opinion; so I am unwilling to place much weight on it.

The more interesting question, anyway, concerns what Descartes *ought* to say about this. Can he consistently explain, through differences in how finely portions of matter are 'actually divided', their offering different amounts of resistance to being diverted by other bodies?

In *The World* he says that matter of the third element has parts which 'are so large or so closely joined together that they always have the force to resist the motions of the other bodies'.<sup>2</sup> The idea is that in a collision between one of those particles and a particle of first-element matter, the former wins. (When in the same paragraph Descartes writes that particles of the *first* element 'move so extremely rapidly and are so minute that there are no other bodies capable of stopping them', he means only that these tiny, agile particles are unstoppable because they cannot be trapped: there are always cracks and crevices through which they can seep. He still holds that they could easily be stopped dead by stationary third-element matter that was crevice-free,

if there were any such.) So Descartes seems to hold that in a collision between a third- and a first-element particle, the former would be entirely unimpeded, not slowed down or re-directed. That would clear the way to his admitting that there could be the absolutely subtle matter which I call separator space.

What makes the third-element particles impervious to interference from first-element ones is that the former are 'so large or so closely joined together'. It is hard to see what Descartes is up to here. One would have thought that two particles that are *jointes ensemble* must be parts of a single particle, in which case the 'joined together' notion can be dropped from the story, leaving us only with size. That is what the translators of the *Principles* say is the message of *Principles* 2:49f, two sections which 'illustrate Descartes's view that. . . resistance to motion depends entirely on relative size. Quantity of motion plays no role whatever except that it must be conserved.'<sup>3</sup> I cannot see that for myself in 2:49f, but apparently Descartes could. He later summed up and justified those sections to Clerselier thus:

Here is the reason why I said that a motionless body could never be moved by another smaller body, no matter how fast this smaller body might be moving. It is a law of nature that if one body moves another, then the former must have more power to move the latter than the latter has to resist being moved by the former. But this surplus can depend only on the size of the body. . . The reason is that if it is set in motion by a body moving twice as fast as some other body,

<sup>1</sup> Letter (1638) to Morin; CSMK 123.

<sup>2</sup> *The World* 5; CSM 1, 89.

<sup>3</sup> V. R. Miller and R. P. Miller, eds, *René Descartes: Principles of Philosophy* (Dordrecht: Reidel, 1983), p. 66., 52.

<sup>1</sup> Letter to Clerselier (1645); CSMK 246. Garber has suggested to me that when writing to Clerselier in 1645, when his own ideas about impact were in a state of flux, Descartes was apt to have misrepresented his own thoughts of a few years earlier. See chapter 8 of Garber's book.

it must receive twice as much motion from it; but its resistance to this motion will also be twice as great.<sup>1</sup> Now, one might try to get out of this a Cartesian explanation of subtleness, with all the work being done by size. A pebble is thrown into a stretch of subtle matter; it gives up speed to (i.e. is resisted by) any given particle of that matter in inverse proportion to how much bigger it is than the particle. The subtler the matter, the smaller its discriminated parts and so the smaller its effect on a large body that collides with it. At the limit—absolutely subtle matter, with ‘indefinitely’ small parts—the effect on the colliding body is nil; the latter gives up none of its speed and does not change its direction, which is to say that the subtle matter has offered no resistance to its passage, behaving instead like separator space. Q.e.d.

This adaptation of Descartes’s rules of impact to yield an account of subtleness is a complete failure, for a reason that Descartes makes plain. The impact rules, he says, are offered subject to conditions which in fact are never realized. He introduces them thus:

How much force to move or resist movement there is in each body. . . could easily be calculated if there were only two bodies colliding, and if they were perfectly hard and were separated from all others in such a way that their movements would be neither impeded nor aided by other surrounding bodies; for then they would observe the following rules.<sup>2</sup>

After stating the rules of impact, he acknowledges that they are hard to apply to actual cases:

Since no bodies in the universe can be so isolated from all others, and no bodies in our vicinity are normally perfectly hard, the calculation for determining how much the motion of a given body is altered by collision

with another body is much more difficult than those given above. <So in order to judge whether the above rules are observed here or not, it is not sufficient to know how two bodies can act against one another on impact.> We have to take into account all the other bodies which are touching them on every side, and these have very different effects depending on whether they are hard or fluid.<sup>3</sup>

On that pivot he modulates into an account of how hard bodies differ from fluid ones. My problem arises just from the presence of other bodies, no matter what they are like; so I shall leave hard/fluid out of account, and attend to the bare fact that Descartes’s rules are stated subject to the condition that the colliding pair are in quarantine.

The difficulty this makes for the proposed account of subtleness is straightforward. The smaller a single particle is, the less it interferes with a body which hits it; but the smaller the particles in a portion of matter, the more of them there are; and the more there are, the greater (one would think) is their combined effect on the body with which they collide. So smallness and numerousness cancel out, so to speak, leaving the proposed line of thought quite empty. This criticism, I should add, applies to the use of *Principles* 2:49f to explain any degree of subtleness, not merely its use in explaining the absolute subtleness which defines separator space.

## 10. The integration problem

This criticism needs to be sharpened, clarified, and deepened; but when I try to meet that need I slam into the brick wall of the *integration problem*, as I call it—the difficulty of bringing into a single coherent picture two utterly different Cartesian

<sup>2</sup> *Principles* 2:45; CSM 1, 45. I have partly used the Millers’ translation.

<sup>3</sup> *Principles* 2:53; CSM 1, 245. I follow CSM in using angle-brackets to enclose material from the French version of this work.



theories about events in the material world. They may well be consistent with one another, but I can find no clear, detailed, and unitary story incorporating both. I expect to return to the integration problem in later writings, and shall merely sketch it here.

**(a) Movement-loop theory.** Descartes is firm in rejecting container space, compression of bodies, and colocation of bodies with bodies.

This triple-C denial entails that no portion of matter can travel unless other matter travels at the same time. An arrow's flight must be associated with two sets of other movements. (i) Its place must be taken by some matter, which must in turn be replaced by other matter, and so on. (ii) The arrow must displace some matter, which must move away and thus displace other matter, and so on. Set (i) is required by the denial of container space and of compression, set (ii) by those and the denial of the colocation of bodies with bodies.<sup>1</sup>

Descartes meets these needs by supposing that the two sets of movements come together not only at the arrow but also somewhere else, creating a finite loop of moving matter: the arrow is replaced by air which is replaced by air which is replaced by . . . air which replaces the arrow. The dependencies amongst movements within the loop are absolute, logical, conceptual; so they do not involve any lapse of time; a body in a loop is required to move as it does at time T by the movement at T of another body on the opposite side of the loop.

(In his famous wine-cask example, Descartes invokes loop theory to explain some empirical data in a manner that might be thought to generate predictions:

When the wine in a cask does not flow from the bottom opening because the top is closed, . . . the wine cannot leave the cask because outside everything is as full as can be, and the part of the air whose place the wine would occupy if it were to flow out can find no other place to occupy in all the rest of the universe unless we make an opening in the top of the cask through which the air can rise by a circular path into its place.<sup>2</sup>

Never mind whether this does promise to have predictive power; the argument as a whole is not worth discussing. Had he reflected on his usual account of vacuum pumps and barometers, Descartes would have seen that the wine-cask argument was not available to him. In my next section I shall sketch his attempt to explain certain empirical data by applying loop theory to the propagation of light. That attempt is defective, though in different ways.)

**(b) Collision theory.** Descartes presents some 'rules' governing collisions between pairs of bodies.<sup>3</sup> This theory has predictive power: from the fact that two bodies are related *thus* and moving *so* a moment before they collide, Descartes's 'rules' purport to let us infer where they will be, and how they will be moving, a few seconds later. In short, his physics of collisions aims to be time-spanning, fertile with predictions, as one would expect of any branch of natural science; whereas the theory of movement loops is

<sup>1</sup> Descartes makes it clear that he is pushed into movement loops by his rejection of compression and container space (*Principles* 2:46; not in CSM); but the denial of colocation of bodies with bodies, which he does not mention in this connection, is also required. For other statements of the movement-loop theory, see *The World* 4; CSM 1, 86; and *Principles* 2:33; CSM 1, 237–239.

<sup>2</sup> *The World* 4; CSM 1, 87.

<sup>3</sup> *Principles* 2:46–52, not in CSM.

not time-spanning, and yields no predictions; it is essentially confined to single moments, telling us that if a particle is moving at T then such and such other things must be happening at T.

That (a) Descartes's movement-loop theory is *toto coelo* different from (b) his collision theory can be brought out in other ways too. For example, (b) can be used to explain why a body starts moving at T, whereas (a) cannot; and (b) embodies a direction from cause to effect, whereas in (a) there is only the symmetrical dependence of every part of the loop on every other.

The problem is to integrate these two parts of Descartes's account of the material world, bringing them together in a single coherent story about what happens when two moving bodies collide. That account would have to say exactly what happens in such a collision, showing how this can bring it about that each body is involved in a synchronous movement loop before the collision and in a different loop after it. I have tried long and hard to do this, and have failed.

(Descartes handles physical transactions sometimes in terms of fluids and sometimes in terms of discrete relatively hard bodies. That is not the split that raises the integration problem, as I now show. Firstly, if we conjoined our loop theory about fluids with a theory of collisions between portions of fluid, the integration problem would still arise. Conversely, if we conjoined our theory about colliding hard bodies with a hard-body form of loop theory (e.g. likening a loop to the iron rim of a turning wheel), again the integration problem would stand untouched. Secondly, Descartes explains that fluids are aggregates of extremely small discrete bodies; and he could instead say, conversely, that a discrete body is a peculiarly coherent portion of fluid. Each explanation is at

least plausible; whereas it would be a lunatic project to try to get collision theory out of movement-loop theory or vice versa.)

In trying to drive deeper into my exploration of whether Descartes's collision theory permits separator space, I keep encountering considerations that involve movement-loop theory. To get further, I need to solve the integration problem, learning how to keep these two balls in the air at once or showing that it cannot be done; I have failed to do either. Crucial as it is for the evaluation of Descartes's work, the integration problem seems to have been ignored in the secondary literature; it may be useful at least to have brought it to light as a problem.

### 11. Subtleness and speed

So much for trying to explain subtleness purely through the smallness of discriminated parts. Descartes, however, often speaks not only of the smallness of those particles but also of their speed relative to one another, treating smallness and rapidity as natural companions. 'The first element surpasses all other bodies in speed', he says, and 'The form I have attributed to the first element consists in its parts' moving so extremely rapidly and being so minute that there are no other bodies capable of stopping them'.<sup>1</sup>

Speed might relate to subtleness in any of three ways. (i) It might be irrelevant to it. (ii) It might help to explain matter's subtleness by helping to explain the fineness of its division. In at least one place, Descartes takes that line: 'The first element is made up of matter which is so violently agitated that when it meets other bodies it is divided into particles of indefinite smallness.'<sup>2</sup> If either (i) or (ii) is right, then speed has no independent place in the

<sup>1</sup> *The World* 5: CSM 1, 89.

<sup>2</sup> *Principles* 2:52; CSM 1, 258.

explanation of subtleness, and this section would not be needed. (iii) However, the speed of the particles of subtle matter might somehow contribute directly to its subtleness. My present topic is the question of whether Descartes does or should hold that it does so.

In my discussion of whether subtleness could come from smallness, I was assuming that if it did, it would be on the principle the smaller the subtler; there seemed to be no other possible link between the two. When we now consider whether subtleness could come from speed, we cannot assume that this would have to involve the principle the faster the subtler. That would imply that absolutely subtle matter—separator space—must have particles moving infinitely quickly; and Descartes could not accept that. He clearly holds that no particle can move so fast. ‘No motion takes place in a single instant of time.’ ‘In order to conceive. . . any possible motion, it is necessary to consider at least two of its instants...and the relation between them.’ ‘No movement can happen in an instant.’<sup>1</sup> There is also other evidence, less direct but more dramatic. The propagation of light is instantaneous, Descartes thought, but he likened that not to a projectile that travels infinitely fast but rather to the supposedly instantaneous production of an effect at one end of a stick by pushing on the other end.<sup>2</sup> In a 1634 letter to Beeckman, he describes empirical evidence which he thinks would show that light travels—that is, the effect travels—instantaneously.<sup>3</sup> The ‘evidence’ depends on a stipulation about how fast light might move if it did take time

(this being understood as resembling a thrown pebble rather than a thrusting stick). Descartes and Beeckman agree that if light takes time to travel it cannot go faster than about eighteen miles per second. This is not a man who thinks there is no limit to how fast matter can move!

Still, speed might help to explain subtleness in some way other than through ‘the faster the subtler’ or its converse. Let us press on.

Some of what Descartes says about subtleness occurs when ‘hard’ bodies which cohere or ‘stick together’ are contrasted with ‘fluid’ ones which easily fall apart. His attempt to explain cohesion seems to incorporate an attempt to explain why bodies differ in how much they resist being shouldered aside by other bodies. Sometimes, indeed, he explicitly gives cohesion a role in the difference between subtle and dense: ‘The only difference between this subtle matter and terrestrial bodies is that it is made up of much smaller particles which do not stick together and are always in very rapid motion.’<sup>4</sup> Descartes seems to be assuming, naturally enough, that these two features of portion P of matter go together:

- (i) The parts of P do not stick together; they are easily separated from one another.
- (ii) P offers little or no resistance to being pushed aside by other matter.

Although it is plausible to think that (i) explains (ii), I am not satisfied that Descartes is entitled to hold that it does; but the reasons for that involve the integration problem, so I shall not pursue them here. Rather, I shall proceed

<sup>1</sup> *Principles* 2:39; CSM 1, 242; *The World* 6; CSM 1, 96f; Letter to Morin (1638); AT 2:215; not in CSMK. I gathered these three references from Garber, *Descartes’s Metaphysical Physics*, p. 174.

<sup>2</sup> I was helped to understand this by correspondence with Richard Field. We now know that Descartes was wrong in his general view about this because no signal can be transmitted faster than the speed of light. As for his ‘stick’ example, he wrongly envisaged the stick as perfectly rigid, when in fact nothing can be so. The push on the knob of the stick makes the other end move because shock-waves pass down the stick, taking time to do so.

<sup>3</sup> Letter to Beeckman; CSMK 46.

<sup>4</sup> Letter to Vorstius (1643); CSMK 46.

on the assumption that Descartes does think that fluidity = non-cohesiveness is intelligibly connected with fluidity = subtleness.<sup>1</sup> Let us then look at his treatment of the latter.

In common with every physicist who denies that there are attractive forces, Descartes cannot solve the cohesion problem, the problem of why the material world is other than perfectly fluid throughout, or of how things ‘stick together’. In *Principles* 2:55 he strongly implies that cohesion is explained by the fact that the parts of the cohering body are at rest with respect to one another: Bodies cannot be held together by ‘any mode distinct from their being at rest. For what mode could be more contrary to the motion that separates them than their being at rest?’ I agree with the commentators who wrote: ‘This is not, of course, an explanation of solidity but a description of the fact that the parts of a solid do not move relative to one another.’<sup>2</sup> Descartes, however, seems to credit it with explanatory power.

Anyway, one section earlier he clearly offers to explain subtleness:

The parts of fluid bodies easily move out of their places, and consequently do not resist the movement of our hands into those places; whereas the parts of solid bodies adhere to one another in such a way that, without sufficient force to overcome their cohesion, they cannot be separated. . . [The reason for this difference is that] a body already in motion does not prevent another body’s occupying the place which it is spontaneously leaving, whereas a body at rest cannot be expelled from its place except by some force <coming from outside>.<sup>3</sup>

This is a terrible explanation! When I try to move my hand eastwards, I am shoving it towards a multitude of little places: a tiny proportion of these, it is true, are just then independently being vacated by particles of subtle or fluid matter moving further eastward; but the great majority of the particles are moving into other little places which are still in the path of my hand, some indeed moving westward, directly against it. There is also a difficulty about speed: even particles that are independently heading east may be moving more slowly than my hand.

Descartes acknowledges the speed (but not the direction) trouble in a letter to Mersenne:

When I conceive of a body moving in a medium which does not resist it at all, I am supposing that all the parts of the surrounding liquid body are disposed to move at the same speed as the original body, both in giving place to it and in entering the place that it is leaving. Thus, every liquid is such as to offer no resistance to *some* movements; but to imagine some matter which did not resist *any* of the different movements of some body, you would have to pretend that God or an angel was moving its parts at various speeds to correspond with the speed of the movements of the body they surround.<sup>4</sup>

This implies that there is no absolutely subtle (= absolutely nonresistant) matter because such matter would require a miraculously ad hoc internal dynamics. The miracle that Descartes envisages has to be a double one: each particle must be caused to move at each moment and at the right speed and in the right direction for it not to impede the hard

<sup>1</sup> The assumption receives support from my next displayed quotation and from CSM 1, 154; CSMK 21f, 52, 63, 121.

<sup>2</sup> Miller and Miller, *René Descartes: Principles of Philosophy*, p. 70, n. 65.

<sup>3</sup> *Principles* 2:54; partly in CSM 1, 71.

<sup>4</sup> Letter to Mersenne (1639); defectively rendered in CSMK 132. The italics are mine.

body that is moving through it.

Those problems for Descartes's explanation of subtleness, though probably fatal, are minor compared with this next one. Think about the adverb in this excerpt from the *Principles* 2:54 passage which I have quoted: 'A body already in motion does not prevent another body occupying the place which it is spontaneously leaving.' Descartes does not mean to attribute a will to the body that is 'spontaneously leaving.' He means only that when I put my finger into water it is not impeded by particles of water which are moving away from it *anyway*, i.e. moving under some influence other than the push from my finger. That may seem safe enough, but I doubt that Descartes can say it, because I doubt that he is entitled to distinguish matter that my finger pushes aside from matter that gives way to my finger for other reasons. That distinction implies that one body

may *take x's place* while another *forces x out*; my finger has an easy time as place-taker because something else is doing the forcing-out. I can find in Descartes's physics and metaphysics no sound basis for separating these two roles. It is easy to see that getting to the bottom of this issue would require—yet again—solving the integration problem. The place-taker role belongs to loop theory, and the forcer-out role to the physics of impact; and we do not know where or how those twain can meet.

In summary: Descartes has no halfway coherent explanation of subtleness in terms of speed. His quarter-coherent explanation supports the view that he is not entitled to believe that any matter is absolutely subtle, i.e. to believe that there is separator space? It is not clear that he can use the concept of speed even to explain why some matter is subtler than some other matter.<sup>1</sup>

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<sup>1</sup> This paper has benefited greatly from comments on drafts of it by Jan Cover, Daniel Garber, John Hawthorne, and Eric Palmer.