

DESCARTES ON PHYSICAL VACUUM: RATIONALISM IN NATURAL-PHILOSOPHICAL DEBATE

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Abstract. Descartes is notorious for holding a strong anti-vacuumist position. On his view, according to the standard reading, empty space not only does not exist in nature, but it is logically impossible. The very notion of a void or vacuum is an incoherent one. Recently Eric Palmer has proposed a revisionist reading of Descartes on empty space, arguing that he is more sanguine about its possibility. Palmer makes use of Descartes' early correspondence with Marin Mersenne, including his commentary on Galileo's *Two New Sciences*. I argue that Palmer's reading is mistaken, and that it relies on an understandable but faulty inference—i.e., that if Descartes considers the implications of an opposing view, he must find it at least coherent. Descartes, as I show from his correspondence and other texts, uses a variety of persuasive strategies, and levels charges of different logical strength, against positions which he takes to be incoherent. Thus we cannot infer from the fact that Descartes argues, e.g., that something is a superfluous theoretical entity, that he admits that entity's coherence. He often chooses to argue a weaker thesis against an opponent so that he can use an argument to which the opponent is more likely to agree.

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Introduction

This paper addresses the interpretation of Descartes' correspondence, chiefly with Marin Mersenne, concerning the vacuum, or empty space. In recent work Eric Palmer has challenged the standard reading of Descartes' position, according to which Descartes rejects the coherence and logical intelligibility of empty space. Palmer argues, with some justification, that Descartes addresses at least two different kinds of vacuum, and that his strict anti-vacuum position applies only to one of them, a highly specific conception of empty space that Descartes found simply incoherent. I argue that Palmer's reading is mistaken, however, and that he makes an understandable but problematic inference from Descartes' correspondence with Mersenne about Galileo's views. Palmer notes that Descartes explores the implications of a view of empty space, and concludes that he finds it at least coherent. I analyze this inference and, to show

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its failure, survey a range of other arguments Descartes makes in his letters and published works. Descartes, it emerges, is quite willing to use a variety of arguments against a position he sees as incoherent, and some of those arguments do not conclude that the position is incoherent. That is, Descartes thinks it more persuasive at times to argue for a weaker claim—e.g., that the rival notion is a superfluous theoretical entity—even though he holds the stronger claim that the notion is incoherent.

I. Descartes' general position on the vacuum

As is well known, Descartes asserted not only that nature contains no empty space, but that such a space—a vacuum or void—is not even possible. The very idea of vacuum is incoherent. Descartes held this position throughout his career. It is true that in his earlier works—the *Regulae* and *Le Monde*, for example—he merely hints that he can prove the claim, rather than setting out an argument.¹ But even in the *Regulae* it is very clear that the idea of empty space is not a mistaken hypothesis in natural philosophy, but is rather the result of a conceptual error.² In *Le Monde* he holds back his full argument, but nonetheless judges the vacuum to be “nothing but a chimera.”³ The correspondence with Mersenne, in particular, shows that Descartes held a strong anti-vacuum position from at least 1630.⁴

In his published works, though, the full articulation and defense of Descartes' position against the vacuum does not appear until the *Principles of Philosophy*, published in 1644. After arguing (*PP* II.4) that extension suffices to constitute the essence of material substance, Descartes analyzes the notions of place and space as dependent on that of body: spatial extension, he claims, is just material extension regarded in a certain way. He then offers, in II.16, his argument against the vacuum “in a philosophical sense of that in which there is no substance whatsoever.”⁵ The argument assumes the earlier result, that spatial extension is really just the same thing as corporeal extension. Descartes appeals to parity of reasoning: since a body's extension justifies “the conclusion that it is a substance,” the same justification applies to the case of “a space that is supposed to be a vacuum.” This philosophical sort of vacuum would, apparently, be an instance of extension that is not the extension *of* anything: an “bulky nothing,” in Jonathan Bennett's formulation.⁶ Hence in *PP* II.18 Descartes claims that it is impossible to think of “the extension apart from the substance which is extended; for, as I have often said, nothingness cannot possess any properties.”⁷

As Roger Woolhouse has carefully shown, the argument against the vacuum in II.16 is not dependent on Descartes' conception of matter as simply extended substance.⁸ Even if he held a “thicker” notion of the essence of material substance, Descartes could make the argument that extension implies substance. Woolhouse goes too far, however, in saying that Descartes' position on the vacuum *tout court* is independent of his definition of material substance. For the vacuum ruled out by II.16 is of a highly specific sort: extension that is not the extension *of* any substance. An objection raised by Dan Garber is helpful here: the fact that material extension and spatial extension are the same does not entail that space and matter are the same.⁹ Space and matter can be extended, such that the property applies univocally to both,

and still they might be fundamentally different kinds of extended substances that relate to one another in certain asymmetrical ways. This is (roughly) Henry More's proposal, as I will discuss below. It is too much, then, to say that Descartes' position on the vacuum is independent of his conception of matter. Rather, it is his arguments against a particular notion of a vacuum that are thus independent.

The *Principles'* argument against the possibility of a vacuum, then, raises at least two questions: how does Descartes argue (or how would he argue) against other concepts of vacuum than that addressed in *PP* II.16; and is it possible that he might allow for the possibility or actuality of some substantive notion of vacuum? The first question demands a treatment more exhaustive than can be accomplished in this paper: Jonathan Bennett has made an attempt at it.¹⁰ My attention here is with the latter question. In the next two sections I present and critique a revisionist interpretation of Descartes' stance on the vacuum, one that gives an affirmative answer to the second question I have just posed.

II. Palmer's Revisionist Reading

In a recent paper Eric Palmer has argued that Descartes is more sanguine about the possibility of the vacuum than the standard account allows.¹¹ On his reading, the stance against the "philosophical vacuum" is narrowly targeted at a certain notion of vacuum that is found in Albert of Saxony and some other scholastics. This notion is traced to thought experiments about the selective annihilation of some piece of matter. Albert's view is that a vessel whose contents were miraculously annihilated would be unchanged from the outside, so to speak, but would in fact contain no volume. It is only this geometrically incoherent idea of vacuum that Descartes regards as contradictory, according to Palmer.

As for a concept of vacuum as extended substance that simply doesn't exhibit the normal range of corporeal properties, Palmer thinks Descartes admits its coherence.

Descartes, like Aristotle, presents two sorts of response in his treatment of vacuum, against two types of position: conceptual analysis of what he takes to be nonsense, and metaphysical explanation and physical argument against what he takes to be competing physical theory.¹²

Palmer's revisionist reading has some virtues which should be acknowledged at the outset. As he points out, much of the literature on Descartes and the vacuum focuses on the early portions of Part II of the *Principles* and late correspondence with More and others. Palmer, by contrast, attends to early letters to Mersenne, including those in which he discusses Galileo's *Two New Sciences*, and especially to the physical theory of *Principles* Parts III and IV. Since Descartes seems to have a strong anti-vacuum position from early in his career, Palmer's attention to texts before the *Meditations* is particularly valuable. In both of these contexts—the Mersenne correspondence and the physical theory of the *Principles*—Descartes appears to be taking ideas of empty space seriously, as proposals worthy of counterarguments within physical theory. After laying out Palmer's view, with particular attention to his reading

of the Descartes-Mersenne correspondence, I will argue that his revisionist reading goes too far, and that he makes an important and revealing mistake in his interpretation of the correspondence.

Palmer takes up two sorts of vacuum that he thinks Descartes countenanced as intelligible: one is macroscopic, the other microscopic. As to the former, Descartes does propose hypothetical physical scenarios in Parts III and IV of the *Principles* that involve the notion of empty space.¹³ To simplify his explanations in this part of his physics, Descartes assumes that the corpuscles of matter he is talking about are moving in a medium with no resistance whatsoever, as if the spaces between them “were filled by a material which neither contributed anything to the motion of other bodies nor in any way impeded it.”¹⁴ Descartes then adds, “For in accordance with what has already been said, there obviously can be no other correct idea of empty space.” Palmer notes, correctly, that in this passage Descartes is allowing empty space only as a kind of idealization or “conceptual simplification.” He goes on to argue, however, that a more substantive proposal is taken seriously by Descartes. (Moreover, Palmer claims that even Descartes’ willingness to make this idealization “suggests his assent to the coherence of the idea of physical vacuum.”¹⁵)

Palmer, however, thinks that this notion of vacuum “would be a body with no humanly detectable property except extension.”¹⁶ He thinks Descartes admits as a possibility a notion of a vacuum that does not move in a continuous path like a body, but just appears in one place while it disappears in another. This kind of vacuum would just be a constant quantity of extension that exhibits no properties, and appears intermittently in various disconnected places in the universe. For example, if there is a gallon of matter and a gallon of physical vacuum in a sealed cylinder, Palmer’s interpretation is that one could flip the cylinder over, so that the matter moves to the other end, without the vacuum having to go through or around the matter. It would just appear on one side of the matter at the same rate it disappears on the other. (My point is not about what Descartes’ physics would predict in such a scenario, just that Palmer’s vacuum does not travel continuously like a body does.) The vacuum, unlike a body, would not travel “with a discernible path.”

Finally, Palmer examines the Descartes-Mersenne correspondence about Galileo’s *Two New Sciences*. He argues that Descartes’ discussion of a Galilean thought experiment shows a willingness to endorse the conceptual intelligibility of microscopic voids. He also claims that a section of *Principles* Part II is meant to address this notion of microscopic voids; Descartes, according to Palmer, rejects these voids, but admits the intelligibility of the proposal. In the following section I will argue against Palmer’s revisionist reading. I will address each of the three types of vacuum he identifies, but I will focus on his treatment of the Descartes-Mersenne correspondence.

III. Against the Revisionist Reading

Palmer reads the “vacuum in a philosophical sense” of *PP* II.16-18 against the background of Albert of Saxony. But surely this is too narrow of a view, and he cites no reason why Albert should be favored over any number of authors Descartes may have been addressing. Edward Grant, Dan Garber, Roger Ariew, Dennis Des Chene, and Cees Leijenhoorst, among others, have collectively illuminated much of the

historical context for Descartes' treatment of space, place, and void.¹⁷ Even among Scholastic authors there is a very wide range of understandings of vacuum, and Descartes also knew of non-Scholastics who endorsed a view of space as something other than substance. So the first problem with Palmer's reading is simply that it restricts Descartes' "official" argument against the vacuum to an overly narrow interpretation; Albert of Saxony is arbitrarily chosen as *the* view that Descartes had in mind in *PP* II.16-18. *Prima facie* Descartes' point should tell against any view that allows for a spatial distance or interval that is not the length of some extended substance. And he thinks the temptation to adopt such a view is nearly universal (as *PP* II.18 makes very clear), whereas Albert's particular kind of vacuum is highly specific.

Palmer claims, as noted above, that in the *Principles* Descartes allows for a type of vacuum that has no detectable property but extension, and which does not move in a discernible path like a body does. But Descartes makes it quite clear in his correspondence with Mersenne that he has nothing so exotic in mind.

In conceiving of a body moving in a non-resistant medium, what I suppose is that all the parts of the surrounding liquid body are disposed to move at the same speed as the original body in such a way as to leave room for it and take up its room. That is why every kind of liquid resists some movement or other. To imagine some matter which resisted none of the different movements of different bodies, 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.¹⁸

Inexplicably, Palmer ignores this passage (while referring to other parts of the same letter) in trying to interpret Descartes' discussions of a physical notion of empty space. This is all the more problematic as the passage closely parallels Descartes' remark at *PP* III.60, quoted above, about the "only correct idea of empty space," which Palmer does cite. The remark to Mersenne goes further in clarifying just how Descartes is conceiving of this empty space, so it is crucial in understanding the sense of empty space that Descartes allows in the *Principles*. There is nothing contradictory, of course, about the supposition that God or an angel is moving matter around in the way described, but it is not a natural possibility, or as we might say, a nomological possibility. That is why Descartes says that "every kind of liquid resists some movement or other." So there is an important difference between this kind of "vacuum" and Descartes' usual target when he attacks the very idea of a vacuum. Descartes regards a space that is immaterial, or a space with no substance in it whatsoever, as logically impossible, but this notion of vacuum as a non-resistant medium is merely naturally or nomologically impossible.

But the fact that he does think of this kind as nomologically impossible shows that Palmer is too sanguine in his estimate of what sort of empty space Descartes allows. Descartes is not committing himself to the physical respectability of extended substance that is completely devoid of physical effect on bodies. Rather, he is doing something scientists have always done in their theorizing: supposing that some

physical factor is negligible for present purposes and treating it as absent. His move here is tantamount to supposing a frictionless plane, or taking air resistance to be negligible, or ignoring tidal effects—the kinds of things physicists do all the time, without thereby committing themselves to the nomological possibility of a frictionless plane or the like. (And while a simplified model such as this may be part of an explanation for some phenomena, the frictionless plane itself can hardly be considered a cause of the actual effect. So in the Galileo case there are good Cartesian reasons for denying that the vacuum can cause motion or cohesion.)

The contexts that Palmer discusses, in which Descartes talks about empty space in his physical theorizing, are easily read as the kind of idealizing or simplifying just noted. His central example is *PP* III.64, where Descartes clearly treats of vacuum within the sphere of the sun (or other star) as a counterfactual scenario.¹⁹ *Pace* Palmer, Descartes' point is not to treat this as an alternative hypothesis to be disposed of, but to emphasize how the action of light works. Far from being some kind of matter shot out from a central emitting force, the action that is light would be almost the same even if the extension within the sphere of the star were completely causally inert. Further, when Descartes points out that an empty space (in the allowable sense specified above) in a vortex would tend to accumulate at the center,²⁰ he is not at all implying that it would not have to travel there in a continuous path. Similarly, if a physicist describes a scenario where gas that is initially evenly dispersed in a fluid gradually accumulates at the top, she can simplify by talking as if the gas merely appears there, without denying that each micro-bubble travels in a continuous path to the top of the fluid. That Descartes is using empty space as this sort of idealization is also clear when he introduces his rules of collision in *Principles* II: "Our calculation would be easy if there were only two bodies colliding, and these were perfectly hard, and so isolated from all other bodies that no surrounding bodies impeded or augmented their motions."²¹

Moreover, if Descartes were to allow the possibility of an extended substance which is not corporeal, in that it is not mobile in anything like the way bodies are mobile, then it would be false that extension entails mobility. But Descartes clearly wants to hold onto the latter claim. It is part of his thesis that extension is sufficient to constitute the nature of body. Thus he writes to Arnauld: "Otherwise, seeing that there is true extension in the space we call empty, and consequently all the properties necessary for the nature of body, we would not say that it was wholly empty, that is, mere nothingness."²² Even more directly to the point, he notes to Mersenne, "Movements in the subtle matter are, I imagine, no different from those we already see in bodies."²³ (Palmer claims that the subtle matter is not the same as the physical vacuum, but the Mersenne correspondence is clear on this: the notion of empty space is that of a perfectly resistance-free medium. It differs from the subtle matter only in that it is an idealization or simplification, whose actuality would require a series of miracles.) So Palmer's "physical vacuum" is not only nomologically but logically impossible, according to Descartes. Palmer, then, overinterprets Descartes' willingness to consider empty space in physical theory: it is not as a hypothesis that competes with his plenism, but as an idealization to simplify certain considerations within his plenist physics. Moreover, Palmer's interpretation of this empty space is too exotic, and

would by Descartes' lights be not only naturally or nomologically impossible, but logically incoherent.

The third sort of vacuum Palmer addresses is like the second, but at a microscopic level. Here his central source is Descartes' discussion, in correspondence with Mersenne, of Galileo's treatment of such microscopic empty spaces. It is worth spelling out the context and content of this discussion in some detail. Mersenne, who became a major proponent of Galileo's mechanics, and who published his own translation and paraphrase of the *Discorsi* in 1639, corresponded repeatedly with Descartes about Galileo's work. Descartes was always reluctant to exert much time and energy in close reading of others' works, but Mersenne managed to extract some responses from him, particularly in 1638, when Descartes read the *Discorsi*. It is noteworthy that the Descartes-Mersenne correspondence through much of 1638 and 1639 features ongoing discussion of the void and related issues. (Indeed, the topic shows up in their correspondence as early 1630.²⁴) In May of 1638 Mersenne asked whether "there would be real space, as there is now, if God had created nothing."²⁵ Descartes, of course, replied in the negative. After Descartes' comments on Galileo, Mersenne asked about subtle matter, the weight of the air, and Descartes' stance on the abhorrence of a vacuum. In addition he also posed another theological thought experiment: what would happen if God annihilated all the matter within a chamber?²⁶ The thought experiment is a challenge to Descartes' absolutist position against the void, and versions of this challenge would later appear from several of Descartes' critics, including Arnauld, Henry More, and Spinoza.²⁷ Descartes revisited this objection, and reiterated his response to Mersenne, in the *Principles*.²⁸ Thus Descartes' and Mersenne's correspondence about Galileo on the void was part of an ongoing conversation about empty space, dealing with both the explanation of proposed physical scenarios, and the consequences of highly theoretical thought experiments.

In the First Day of Galileo's *Discourses and Mathematical Demonstrations Concerning Two New Sciences* ("*Discorsi*"), the characters of the dialogue discuss the existence of voids or empty spaces. Galileo has Salviati propose that tiny vacua, microscopic void spaces, could explain the cohesion of solid bodies. He builds an analogy between solidity and observed vacuum effects (i.e., suction and adhesion) and then argues, by way of a discussion of infinitesimals, that infinitesimal voids could do the explanatory work.

Initially, however, the conversation is focused on whether there is void space, and whether nature abhors it. The very first "clear experience" that Salviati adduces in support of an affirmative answer is the case I will focus on here. Here is the passage in full:

To begin with, we may see whenever we wish that two slabs of marble, metal, or glass, exquisitely smoothed, cleaned, and polished and placed one on the other, move effortlessly by sliding, a sure argument that nothing gluey joins them. But if we want to separate them while keeping them parallel, we meet with resistance; for the upper slab in being raised draws the other with it, and holds it permanently even if it is large and heavy. This clearly shows nature's horror at being forced to allow, even for a brief time, the void space that

must exist between the slabs before the running together of parts of the surrounding air shall occupy and fill that space. It is also observed that if the two surfaces are not perfectly clean, so that their contact is not everywhere perfect, and we want to separate them slowly, the only resistance we feel is that of the heaviness [of the upper slab], whereas in rapid separation the lower stone is also lifted and immediately falls back, following the upper one only during the brief time that suffices for the expansion of the small amount of air between the imperfectly fitting surfaces, and for entrance of surrounding air.²⁹

Descartes's reply to Galileo is characteristically terse, initially:

In order to explain why the parts of a continuous body hold together, he suggests two causes. One is the abhorrence of a vacuum, the other a sort of glue or bond which holds them together, which he explains later on in terms of a vacuum. I think both explanations are quite false. What he ascribes to a vacuum (page 13) should be ascribed only to the weight of the air. If it were abhorrence of a vacuum that prevented two bodies from separating, there would certainly be no force capable of separating them.³⁰

The clause "what he ascribes to a vacuum" refers to the adhesion of the marble plates. In Descartes' view the weight of the air (or more broadly, the surrounding medium) is the explanation for all physical phenomena that seem to involve the *horror vacui*. Weight, in turn, is caused by vortex motion. In a rotating system of matter, larger chunks of matter will move towards the center, Descartes says. This is because the subtler matter surrounding the earth (or other heavenly body) tends to recede from the center as it rotates. Since it moves faster than more solid material, it has a greater tendency to move away from the center. But the space it leaves behind must of necessity be filled by other matter, since there is no vacuum.³¹ Descartes' example of a wine-cask in *The World* shows how he thinks the weight of the air produces sensible effects:

When the wine in a cask does not flow through an opening at the bottom because the top is shut tight, it is improper to say, as is commonly done, that this takes place because of 'fear of a void'. ... Instead, what we must say is that the wine cannot leave the cask because outside everything is completely full, and the part of the air whose place the wine would occupy if it were to flow out can find nowhere else in the universe to occupy, unless an opening is made in the top of the cask through which the air can rise in a circle into its place.³²

Now, this passage by itself does not explain that matter more subtle than air could penetrate the cask and take the place of the wine as it flows out. This would complete the loop of matter in motion that Descartes' rigid plenum requires, but it would require the whole sphere of air to be increased, corresponding to the displaced

volume, now filled by subtle matter. Thus scenarios wherein air is moved, but air (or other weighty matter) is impeded from filling the vacated space, exhibit the effects of the weight of air.

Descartes makes this clear when he gives a fuller response to the adhesion of two polished pieces of marble. Mersenne proposed that the scenario could allow the measurement of the weight of the air: presumably the maximum weight of marble that could be lifted by such adhesion would provide the measure. Descartes is skeptical that the surfaces can be sufficiently even and smooth to eliminate all air between them.³³ He goes further, suggesting that the scenario poses no objection to his rejection of the vacuum, even if one supposes that it could be physically realized:

And I do not see at all the force of your objection: for if A is perfectly joined to B, one cannot separate it while drawing it perpendicularly upwards, without removing at the same instant all the parts of the lower surface of A from those of the upper surface of B. And since the air cannot enter in one instant into the space that they leave between them, it is necessarily void in that instant, and filled only by subtle matter—which is the cause why we must then sense the weight of the whole column of air which is above. But nothing of the sort happens when one draws A obliquely, at an angle towards D, because the separation of these two bodies, since it then takes place successively, poses no difficulty for the air's entrance into the place that remains.³⁴

This passage can be read as responding to challenges in a few different ways. First, if one claims that this example establishes the possibility or actuality of a vacuum, where that means a space empty of all matter, Descartes' response is that even if the whole scenario is conceded, there will still be subtle matter between the two faces of marble. (This is even clearer in the Victor Cousin edition, where we find “it is necessarily void *of air* in that instant, and filled only by subtle matter”; more on this below.) If one objects that he has no way to explain the adhesion itself, he appeals to the weight of the air. And finally, Descartes objects to the interpretation of the physical scenario as a geometrically precise separation of two precisely parallel plane surfaces. Thus to Descartes' mind the scenario poses no difficulties for his view whether it is considered as an idealized thought experiment or as an actual physical experiment.

Palmer claims that Descartes contemplates “the coherence of the possibility of vacuum” in this context.³⁵ According to him, Descartes concedes the conditional claim that if one could separate them in that fashion, then a void would exist for a very short time.³⁶ Thus, Descartes is allowing that some kind of physical vacuum is at least coherent. Palmer's reading of this passage seems highly questionable on its face, since Descartes appears to be talking merely about a space void of *air*; Palmer points out the variant text in the Cousin edition. But in either case Descartes says that the space “is filled only by subtle matter”, so the reading seems simply incorrect.

But let us suppose *arguendo* that Palmer is right: Descartes concedes that if one could separate the slabs in a perfectly perpendicular direction, a vacuum would exist

for a short time. Palmer's conclusion is that Descartes thinks that the consequent is at least coherent. But this only follows if Descartes thinks that a perfectly parallel separation of two perfectly smooth (and impermeable) surfaces is logically possible, and there is every reason to think that Palmer's *modus ponens* is Descartes' *modus tollens*. That is, since the vacuum is logically impossible, so is such a scenario. (If he means merely a space void of air, then he is denying natural or nomological possibility; if he means a space void of everything, then he is denying logical possibility.)

Thus Palmer is incorrect to take Descartes conditional statement as evidence that he thinks the vacuum is conceivable. This is further supported by Descartes' remark concerning Galileo on the abhorrence of a vacuum: "If it were abhorrence of a vacuum that prevented two bodies from separating, there would certainly be no force capable of separating them."³⁷ Palmer cannot make sense of this statement: "Indeed, if the interpretation of the discussion of vacuum in the *Principles* that I have sketched is appropriate, and appropriate to his thinking at that time, he himself ought to have found it valueless."³⁸ But Descartes' remark makes perfect sense if is talking about an incoherent notion of vacuum. No force can bring about something logically impossible. I conclude that Palmer's distinction between types of vacuum doesn't successfully map onto Descartes' thinking.

IV. Descartes' Argument Strategies against Incoherent Views

Palmer's reading, in the case of the Galilean thought experiment, depended on an understandable but problematic inference. He noticed Descartes considering a conditional statement of the form, "if p then q ," where q is the statement that a vacuum exists. Palmer concluded that Descartes must be taking p and q to be at least coherent views. As I noted above, it makes more sense to conclude that Descartes rejects the coherence of the antecedent as well as that of the consequent. This may seem strange, but Descartes has no qualms about judging what appear to be specifiable physical scenarios as logically impossible, if their possibility entails that of a vacuum.

Henry More objected to Descartes that surely God, the universal cause of motion, can create a vacuum:

When you imply that not even divine power is able to bring about a vacuum, strictly speaking, and that if all body were removed from a vessel, the sides would necessarily come together, this indeed seems to me not only false, but inconsistent with what came before. For if God imparts motion to matter, as you have held, can he not press against the sides and prevent them from coming together?³⁹

Notably, More is describing a scenario wherein God *removes*, rather than annihilates, the contents of a vessel, while also holding back the sides of the vessel so that they do not "collapse", so to speak. Descartes is forthright in his response: the scenario More describes is inconceivable. While he does not deny God the power to do it, since he will not deny God the power to make $2+2=5$, More's scenario, however plausible its narration, involves a contradiction.

For I say elsewhere that all motion is in a manner circular [PP II 33]; from which it follows that it cannot be distinctly understood that God should remove some body from a container unless we understand at the same time that another body, or the sides of the container, should move into its place by a circular motion.⁴⁰

Descartes is quite willing to accept the conditional claim, that *if* God were to remove the contents of a container while holding the sides (and all other matter) out of it, *then* there would be a vacuum. But both the antecedent and the consequent are incoherent, unsuccessful attempts to specify a possible scenario.

This is part of a broader pattern of argument strategy in Descartes. Even when he holds some opposing view to be incoherent, he sometimes brings weaker charges against it, such as theoretical superfluity. Thus, in contexts where his position rests on the claim of clear and distinct perception, Descartes sometimes uses an argument from simplicity or economy to make his case. This is evident in the *Meteorology* when he explicitly avoids the assertion that there is nothing real in the nature of bodies other than the geometrical properties he appeals to in that work. Instead, he says, he merely makes the weaker claim that he does not need to appeal to any such entities as real accidents or substantial forms in order to give explanations.⁴¹ In his replies to Arnauld's objections to the *Meditations*, and again in a letter to Regius, Descartes makes it very clear that this was a purely strategic move.⁴² He has no real misgivings as to whether there might really be substantial forms in bodies, for example. It is more effective as a means of persuasion, however, as well as politically safer for Descartes to argue by inference to the best explanation in this case. As he puts it to Mersenne, "The principal aim of my metaphysics is to show which are the things that can be distinctly conceived."⁴³ In some cases this goal can, he thinks, be accomplished without explicitly rejecting certain ideas that he does in fact reject as inconceivable.

The goal, however, is to persuade people that these ideas are in fact incoherent pseudo-concepts.

Now in such matters, saying that one does not wish to make use of these entities is almost the same as saying one will not accept them; indeed, they are accepted by others only because they are thought necessary to *explain* the causes of natural effects.⁴⁴

In this passage we see clearly that Descartes advanced what amounts to a demonstration that certain entities were *unnecessary*, even though his view is that they are *incoherent*. This argument strategy is a sensible one for Descartes, given that he thinks that many, if not most, of our pre-philosophical ideas are incoherent, and that many philosophical theories merely enshrine those pre-philosophical prejudices into a sophisticated set of forms.

The belief in the possibility or even actuality of a vacuum is, for Descartes, a clear case of empiricist prejudice solidified during our childhoods. He does think there

is a proper notion of “empty” space: when some place does not contain the sort of matter we expect to find there, we call it empty. But a space can only be “empty of x” and “empty of y”, so to speak. Emptiness is a relative notion, and is to be deployed according to the expectations appropriate for a given context. When a jug we expect to contain water has no water in it, we say that it is empty. When a space contains no perceptible matter, we call it empty.⁴⁵ So, in physical discussions, the notion of empty space is legitimate only if we use it to indicate a space that does not contain a certain sort of matter. Hence, in the *Principles*, the idea of empty space is simply that of a resistance-less medium: the space is empty insofar as it is a part of matter so fluid that it does not resist the motions of any other bodies that enter it. As pointed out above, Descartes is not saying that such matter is fundamentally of a different kind than other matter; rather he is simply regarding the resistance of the medium as negligible.

The notion of emptiness as Descartes understands it structures his genealogy, as it were, of the belief in a vacuum. In *Principles* II.18, after laying out his understanding of emptiness as emptiness-of-x, he offers an account of how we all, pre-philosophically, come to believe in the possibility of a space that is empty of all matter.

Seeing no necessary connection between a vessel and the body contained in it, we reckoned there was nothing to stop God, at least, removing the body which filled the vessel, and preventing any other body from taking its place. But to correct this error we should consider that, although there is no connection between a vessel and this or that particular body contained in it, there is a very strong and wholly necessary connection between the concave shape of the vessel and the extension, taken in its general sense, which must be contained in the concave shape.⁴⁶

The error, as Descartes sees it, is not just one of the pre-philosophical mind. Accounts of space and matter that allow for a vacuum are elaborations of this basic error, no matter how sophisticated they become. Thus he writes to More,

On this topic I did not hesitate to disagree with great men such as Epicurus, Democritus and Lucretius, for I saw that they were guided by no solid reason, but only by the false preconception with which we have all been imbued from our earliest years.⁴⁷

Whereas the commonsense view of empty space thinks of it as literally *nothing* (based on the empiricist prejudice that aligns reality with the sensible), the philosophical elaboration of the vacuum error may go in a number of different ways. It may try to specify some sense in which space exists while being less real than a substance. It may bite the bullet and embrace the view that a vacuum is literally nothing. Or it may concede that extension always belongs to a substance, but deny that extension entails the full spectrum of material properties. But in any case it cannot avoid the incoherence that stems from the original error.

Hence when challenged by Arnauld on the vacuum, Descartes first replied that he had nothing to say that was not already in his *Principles*. When Arnauld pressed further, Descartes responded by giving a *diagnosis* rather than a counterargument; he recounts the error theory delineated in *Principles* II.18. First, we do not sufficiently consider that nothing has no properties—a failing which, as we saw, comes from our empiricist prejudices. Second, we are misled by thinking about God’s omnipotence into affirming that the vacuum is logically possible. In the course of this diagnosis Descartes again affirms, without argument, that when we perceive extension we also perceive “all the properties necessary for the nature of body.”⁴⁸

Of course, as Palmer points out, “we, and apparently some of [Descartes’] contemporaries, do not find a contradiction, or even a difficulty, in carefully conceiving of vacuum or void as a space without material bodies within it.”⁴⁹ But Descartes is skeptical about his interlocutors’ ability to know their own minds. He says of those who claim to distinguish quantity from extended substance that “there is ... no correspondence between their verbal expressions and what they grasp in their minds.”⁵⁰ In a letter to Hyperaspites Descartes is even more explicit. His correspondent had pointed out that others deny having the idea of God as Descartes characterizes it in the *Meditations*. Descartes responds by distinguishing judgment from perception:

I do not remember that I ever expressed surprise ‘that not everybody is aware of the idea of God in himself; for I have often observed that what men judge does not accord with what they understand. I do not doubt that everyone has within himself an implicit idea of God, that is to say, an aptitude to perceive it explicitly; but I am not surprised that not everyone is aware that he has it or notices that he has it. ... *In the same way, people judge that so-called empty space is nothing; all the same they conceive it as a positive thing* ... and in many other matters people’s judgements disagree with their perception.⁵¹

In other words, everyone has the idea of a thing whose essence is constituted by extension, but most are unaware that they have it.

In sum, Descartes regards his opponents on space and vacuum as deeply mistaken about their own ideas: they are engaged in the doomed project of systematizing their incoherent empiricist prejudices. Hence alongside of conceptual arguments he deploys other persuasive strategies: arguments that the opponent’s theoretical entities are superfluous, and genetic accounts of the error that underlies the opponent’s position. Palmer seeks to divide Descartes’ arguments neatly into two sorts, where Descartes offers “conceptual analysis of what he takes to be nonsense, and metaphysical explanation and physical argument against what he takes to be competing physical theory.”⁵² As the foregoing shows, this neat division does not match Descartes’ practice, which is much more opportunistic and dialectical. Descartes does not suppose that conceptual analysis on a given subject is sufficient to defeat our deep-seated confusions, which in turn are based on the prejudices of our childhoods. Hence the interpretive inference that Palmer makes in reading the discussion of Galileo—where a consideration of the implications of an opposing view

is supposed to entail that Descartes regards that view as coherent—fails. Descartes does not use only the logically strongest charge against a position he is addressing. He aims to persuade, and merely noting the incoherence of the opponent's notion does not make enough contact with the opponent's understanding for persuasion to occur. In his judgment, sometimes a weaker charge (e.g., that the opponent's position involves superfluous entities), or an indirect route (e.g., a genetic account of the opponent's view as an error), is more effective.

Conclusion

Descartes' treatment of the vacuum is indeed more multi-faceted and subtle than is often recognized. Palmer's revisionist reading, however, goes too far in some respects, and simply misses the mark in others. It takes the physical vacuum of the *Principles* Parts III and IV to be something radically unlike matter in its behavior, whereas Descartes tells Mersenne, in the very correspondence Palmer emphasizes, that he has no such thing in mind. More interestingly, Palmer reads a level of openness to the vacuum's coherence into Descartes' treatment of Galileo's *Two New Sciences*. But the inference that grounds that reading is faulty, because Descartes quite frequently uses at least a few different kinds of arguments against one and the same position or concept. So it cannot be inferred from his use of, e.g., an argument from simplicity, that the view he is opposing is something he considers to be intelligible or coherent. Which sort of argument Descartes uses will vary depending on the interlocutor. Descartes' strict rationalism does not prevent him from deploying a range of persuasive strategies; by the same token, the presence of some less stringent argumentative consideration of an opposing view does not, in itself, indicate a moderation of the core Cartesian position.

References

- ¹ AT X, 424; CSM I, 48. AT XI, 20-21; CSM I, 87. AT I, 140; CSMK, 22. "AT" refers to René Descartes, *Oeuvres*, ed. Ch. Adam and P. Tannery (Paris: Vrin/CNRS, 1966-76). "CSM" refers to J. Cottingham, R. Stoothoff, and D. Murdoch, eds. and translators, *The Philosophical Writings of Descartes*, Vols. I-II (Cambridge: Cambridge University Press, 1985). Volume III, containing Descartes' philosophical correspondence translated by Anthony Kenny (1991) as well as CSM, will be referred to as "CSMK."
- ² AT X, 444-445; CSM I, 60.
- ³ AT XI, 20; CSM I, 87.
- ⁴ AT I, 140; CSMK, 22.
- ⁵ AT VIII A, 49; CSM I, 229.
- ⁶ Bennett, J., *Learning from Six Philosophers* (Oxford: Clarendon, 2001), Vol. 1, 38.
- ⁷ AT VIII A, 50; CSM I, 230-231.
- ⁸ Woolhouse, R., "Descartes and the Nature of Body", *British Journal of the History of Philosophy* 2 (1994): 19-33.
- ⁹ Garber, D., *Descartes' Metaphysical Physics* (Chicago: University of Chicago Press, 1992), 132.
- ¹⁰ Bennett, J., "Space and Subtle Matter in Descartes's Metaphysics", in *New Essays on the Rationalists*, ed. R. Gennaro and C. Huenemann (Oxford: Oxford UP, 2002), 3-25.
- ¹¹ Palmer, E., "Descartes on Nothing in Particular", in Gennaro, R. and Huenemann, C., (2002), 26-47.

¹² Palmer, E., (2002), 43.

¹³ Palmer discusses these at 35-37.

¹⁴ AT VIII A, 112. The translation is from *Principles of Philosophy*, trans. V.R. Miller and R.P. Miller (Dordrecht: Kluwer, 1991), 115.

¹⁵ Palmer, E., (2002), 35.

¹⁶ Palmer, E., (2002), 36.

¹⁷ Grant, E., *Much Ado about Nothing: Theories of Space and Vacuum from the Middle Ages to the Scientific Revolution* (Cambridge: Cambridge UP, 1981). Garber, D., (1992), Ch. 5; Des Chene, D., *Physiologia: Natural Philosophy in Late Aristotelian and Cartesian Thought* (Ithaca: Cornell UP, 1996); Leijenhorst, C., *The Mechanisation of Aristotelianism: The Late Aristotelian Setting of Thomas Hobbes' Natural Philosophy* (Leiden: Brill, 2002), Ch. 3; Ariew, R., *Descartes among the Scholastics* (Leiden: Brill, 2011), 87-92.

¹⁸ AT II, 482-3; CSMK, 132.

¹⁹ AT VIII A, 115.

²⁰ Palmer, E., (2002), 36.

²¹ AT VIII A, 67; CSM I, 244.

²² AT V, 223; CSMK, 358. My italics.

²³ AT II, 484-5; CSMK, 133.

²⁴ AT I, 140; CSMK, 22.

²⁵ AT II, 138; CSMK, 102.

²⁶ AT II, 482; CSMK, 132.

²⁷ I discuss More and Arnauld below; for Spinoza's argument see *Ethics* Ip15S: *The Collected Works of Spinoza*, ed. and trans. E.M. Curley (Princeton, N.J.: Princeton UP, 1985), 423. For a recent analysis showing exactly how this text is targeted at the Cartesian position, see Robinson, Th., "Spinoza on the Vacuum and the Simplicity of Corporeal Substance", *History of Philosophy Quarterly* 26 (2009): 63—82.

²⁸ AT VIII A, 50; CSMK, 231.

²⁹ Galileo, *Opere di Galileo Galilei*, ed. A. Favaro (Florence: Edizione Nazionale, 1890—1910), Vol. VIII, 59. English translation from *Two New Sciences, including Centers of Gravity and Force of Percussion*, trans. S. Drake (Toronto: Wall & Emerson, 1989), 19-20. *E prima, il vedersi, quando ne piaccia, due piaster di marmot, di metallo o di vetro, esquisitamente spianate pulite e luster, che, posata l'una su l'altra, senza veruna fatica se gli muove sopra strisciando (sicuro argument che nissun glutine le congiugne), ma che volendo separarle, mantenendole equidistant, tal repugnanza si trove, che la superior solleva e si tira dietro l'altra e perpetuamente la ritiene sollevata, ancorchè assai grossa e grave, evidentemente ci mostra l'orrore della natura nel dover ammettere, se ben per breve momento di tempo, lo spziao voto che tra di quelle rimarrebbe Avanti che il concorso delle parti dell'aria circostante l'avesse occupato e ripieno. Vedesi anco, che quando bene tali due lastre non fussero esattamente pulite, e perciò che il lor contatto non fusse esquisito del tutto, nel volerle separar lentamente niuna renitenza si trova fuor di quella della sola gravità; ma in un alzamento repentino l'inferior pietra si solleva, ma subito ricade, seguendo solamente la sovrana per quel brevissimo tempo che basta per la distrazzione di quella poca d'aria che s'interponeva tra le lastre, che non ben combaciavano, e per l'ingresso dell'altra circumfusa.*

³⁰ AT II, 382; CSMK, 125.

³¹ Cf. AT II, 544; CSMK, 135-6. Also *The World and Other Writings*, trans. and ed. S. Gaukroger (Cambridge: Cambridge UP, 1998), Ch. 11, AT XI, 73ff. For a discussion of Descartes on weight, see Shea, W.R., *The Magic of Number and Motion: the Scientific Career of Rene Descartes* (Canton, MA: Science History Publications, 1991), 288; for his response to Pascal's vacuum experiments, see Garber, D., (1992), 136-143.

³² AT XI, 20. Translation from *The World and Other Writings*, ed. S. Gaukroger, (1998), 15.

³³ AT II, 481. “...mais il ne me semble pas qu'on puisse avoir 2 cors plats d'aucune matiere, qui soient si durs, si polis, & se rapportent si exactement l'un a l'autre, qu'il ne demeure aucun air entre deux.”

³⁴ AT II, 481. *Et je ne voy point du tout de difficulté en votre objection: car si A est parfaitement joint a B, on ne l'en peut separer, en le tirant en haut perpendiculairement, qu'on ne face éloigner en un mesme instant toutes les parties de sa superficie inferieure de celles de la superficie superieure du cors B; et pource que l'air ne peut entrer en un instant en l'espace qu'elles laissent entre ells, il en est necessairement vuide en cet instant la, et seulement rempli de matiere subtile, ce qui est cause qu'on doit alors sentir la pesanteur de toute la colomme d'air, qui est au dessus. Mais il n'arrive rien de semblable, lorsqu'on tire de biais A vers D, car la separation de ces 2 cors se faisant alors successivement, l'air entre sans difficulté en la place qu'ils laissent.* My translation.

³⁵ Palmer, E., (2002), 41.

³⁶ AT II, 482; CSMK, 132.

³⁷ AT II, 382; CSMK, 125.

³⁸ Palmer, E., (2002), 42.

³⁹ AT V, 240-241. My translation.

⁴⁰ AT V, 272-3; CSMK, 363.

⁴¹ AT VI, 239; CSM II, 173n2.

⁴² AT VII, 249; CSM II, 173. AT III, 491-2; CSMK, 205.

⁴³ AT III, 192; CSMK, 154.

⁴⁴ AT III, 500; CSMK, 207. My italics.

⁴⁵ AT VIIIA, 49; CSM I, 230.

⁴⁶ AT VIIIA, 50; CSM I, 230.

⁴⁷ AT V, 271; CSMK, 362.

⁴⁸ AT V, 223; CSMK, 358.

⁴⁹ Palmer, E., (2002), 28.

⁵⁰ AT VIIIA, 79; CSM I, 247.

⁵¹ AT III, 430-1; CSMK, 194. My italics.

⁵² Palmer, E., (2002), 43.