

3. FORCE: THE DYNAMICAL LEVEL

3.1 *The refutation of the Cartesian doctrine of body*

Cartesian physics was still very much alive when Leibniz began to work out his own ideas about physics in the 1670s and 1680s. A reasonable place to begin our account of Leibniz's views on the physical world is with an account of his rejection of the Cartesian doctrine of the nature of body, and his advocacy of a conception of body grounded in the notion of force; in this is grounded his dynamics.

Basic to Descartes and his many followers was the view that the essence of body is extension; bodies, for Descartes, were the objects of geometry made real. As a consequence, Descartes held that all of the bodies' properties are broadly geometrical, including size, shape, position with respect to other bodies, and motion. This was central to Cartesian mechanism, because all there is in body is extension and its modes everything in physics must be explicable in those terms.⁴⁴

Leibniz shared the mechanical philosophy of the Cartesians; for him, too, everything was explicable in terms of size, shape, and motion. But though he shared the physics, he did not share the metaphysics on which Descartes had grounded his mechanism. While bodies may be extended, Leibniz held that this was not their essence.

Leibniz offers a number of interesting arguments against the

Cartesian conception of body, from a number of different premises, and leading to a number of different conclusions.

First, there are arguments showing the insufficiency of the notion of extension for defining body. Leibniz argues that extension cannot be the essence of body, as Descartes and his followers claim, because extension is not the sort of thing that *can* constitute the essence of *anything*; it is a relative concept, he claims, and is comprehensible only with respect to some quality or other that is extended (see, e.g., G IV 467; letter to Malebranche, 1693–94?; G I 352; to De Volder, 24 March /3 April 1699, G II 169–70; AG 171–72; G IV 393–94; AG 251; G VI 584; AG 261). Leibniz also offers a somewhat puzzling argument to the effect that insofar as bodies in the real world are actually divided to infinity, strictly speaking they have no shape. Since one cannot have an extended thing that has no shape, extension cannot constitute the essence of body.⁴⁵ These arguments, interesting as they are, lead us away from the Cartesian position, but don't lead clearly toward anything else.

Other arguments, though, give us more insight into Leibniz's own position. One of the most important such arguments is what might be called the aggregate argument. This is the main argument he uses against the mechanist ontology in the letters he wrote to Arnauld in the late 1680s. There he focuses on the fact that for most Cartesian mechanists, body is infinitely (or, to use Descartes' phrase, indefinitely) divisible.⁴⁶ In writing to Arnauld, Leibniz announces: "I hold this basic proposition, differentiated only by the emphasis to be an axiom, namely, that *what is not truly one being is not truly one being either*" (letter to Arnauld, 30 April 1687; G II 97; AG 86). So, Leibniz concludes, the ultimate existents in his world must be things that are genuinely one, genuine unities. Thus, Leibniz claims that the reality of aggregates must depend on the reality of the individuals that make up those aggregates: "I do not agree that *there are only aggregates of substances*, and if there are aggregates of substances, there must also be true substances from which all the aggregates result"^{x1} (letter to Arnauld, 30 April 1687, G II 96; AG 85). Now, Leibniz claims that extended things, at least inanimate extended things, are by their nature aggregates; *any* body, taken by itself is only an aggregate of the parts into which one can divide it (see the discussion in letter to Arnauld, 28 November/8 December 1686, G II 76; AG 79). And so, Leibniz concludes:

We must then necessarily come down either to mathematical points of which some authors constitute extension, or to the atoms of Epicurus or Cordemoy (which things you reject along with me), or else we must admit that we do not find any reality in bodies; or finally we must recognize some substances that have a true unity.

(Letter to Arnauld, 30 April 1687, G II 96: AG 85)

That is, for extended bodies to be real, they must ultimately be composed of things that are genuine unities, something that cannot be found in extension alone.⁴⁷

The aggregate argument turns on the fact that in the infinitely divisible bodies of the Cartesians there are no genuine individuals, and thus no reality, properly speaking. Another argument Leibniz gives goes even a step further. In sec. 13 of the important essay "On Nature Itself" (1698), Leibniz presented a general argument intended to show that if the world is full, and full of matter uniform in its nature (both of which follow from the doctrine of body as extension Descartes held), then change is impossible. Leibniz argues:

For if no portion of matter whatsoever were to differ from equal and congruent portions of matter, . . . and furthermore, if one momentary state were to differ from another in virtue of the transportation of equal and interchangeable portions of matter alone, portions of matter in every way identical, then, on account of this perpetual substitution of indistinguishables, it obviously follows that in the corporeal world there can be no way of distinguishing different momentary states from one another. (G IV 513: AG 163–64)

The problem Leibniz has in mind here is not merely epistemological, a matter of our not being able to *tell* whether or not the world is changing (though given our evident experience of change, this would be problem enough for the mechanist); the problem is deeper, that given the common mechanist conceptions of body, it doesn't even make *sense* to talk about same and different with respect to body: "under the assumption of perfect uniformity of matter, one cannot in any way distinguish one place from another, or one bit of matter from another bit of matter in the same place" (G IV 513–14: AG 164).^{48 3}

These arguments establish that bodies must be grounded not in bare geometrical extension but in some sort of unities; genuine individuals.⁴⁹ Leibniz's conception of these individuals is further fleshed

out in another series of arguments against the Cartesian doctrine of body that emphasize the notions of force and activity.

First, there is a suggestion that the Cartesian view of body is refuted by the very refutation of the Cartesian conservation principle, and that when we substitute the conservation of $(mv^2)^{47}$ for the Cartesian size times speed, it follows that we must introduce something into body over and above extension. Leibniz writes to Bayle about his new conservation law, shortly after the publication of the BD:

I would like to add a remark of consequence for metaphysics. I have shown that force ought not to be estimated by the product of speed and size, but by the future effect. However, it seems that force or power is something real at present, while the future effect is not. From which it follows *that we must admit in bodies something different from size and speed, at least unless one wants to refuse bodies all power of acting.*

(Letter to Bayle, 9 January 1687, G III 48)

The argument is somewhat obscure, but what Leibniz seems to have in mind is this. For the Cartesian, all there is in body must be geometrical, size and speed. But if the ability-to do work is conserved, for example, the ability a body has to raise itself a certain height, then it is not size times speed that is conserved, but size times the square of speed.⁴⁸ That is to say that neither size nor speed (nor their product) can represent in a body at a time n the ability that that body has at some future time to do work. But since the body really does have that ability at time n , there must be something it has at time n by virtue of which it has that future ability, something that goes beyond its geometrical properties; this is what Leibniz calls force.⁴⁹

Perhaps more intelligible is another kind of argument Leibniz appeals to, an argument that derives from the claim that Cartesian bodies, the objects of geometry made real, must be completely inert, and indifferent to motion or rest. This argument is used in a wide variety of texts in the late 1680s and throughout the 1690s. Leibniz sketches the argument in the *Discourse on Metaphysics*:

If there were nothing in bodies but extended mass and nothing in motion but change of place and if everything should and could be deduced solely from these definitions by geometrical necessity, it would follow . . . that upon contact, the smallest body would impart its own speed to the largest

body without losing any of this speed; and we would have to accept a number of such rules which are completely contrary to the formation of a system. (*Discourse*, par. 21, G IV 446–47; AG 53–54)⁵⁰

The argument is clear enough. If bodies were just extended, as the Cartesians say, then they would have to obey certain absurd laws of motion; in particular, the smallest body in motion could move the largest body at rest without losing any of its own motion, as in Leibniz's own early physics. But this is absurd, in contradiction both with experience, and with metaphysics, since in a world governed by such a law, the mv^2 in a collision could increase or decrease, depending upon circumstances, resulting in violations of the principle of the equivalence of cause and effect. And so Leibniz concludes, there must be something in bodies over and above mere extension, something from which the force of resistance can arise.⁵¹

This argument is not entirely fair to Descartes and his followers. The laws Leibniz criticizes in this argument are not Descartes', nor do they belong to any of his followers; Descartes himself certainly recognized a kind of resistance in bodies, something that he traced back to God, the ultimate source of motion in the physical world.⁵² But his isn't good enough for Leibniz. In 1702 Leibniz writes:

Though in origin [motions] ought to be attributed to God, the general cause of things, however, directly and in particular cases, they ought to be attributed to the force God placed in things. For to say that, in creation, God gave bodies a law for acting means nothing, unless, at the same time, he gave them something by means of which it could happen that the law is followed; otherwise, he himself would always have to look after carrying out the law in an extraordinary way. But indeed, his law is efficacious, and he did render bodies efficacious, that is, he gave them an inherent force.

(G IV 396–97; AG 253–54; cf. SD part I, par. 11, GM VI 241–42; AG 125; "On Nature Itself," G IV 508–09; AG 159–60; G IV 568; L 583)

But if force is in the bodies themselves, then they cannot be the inert extended things that they are for the Cartesians.

These arguments establish that the bodies of the mechanical philosophy are not things merely extended. Rather, Leibniz argues, they are grounded in genuine unities that are the seat of forces in the world. But to fully understand Leibniz's position here, we must understand what exactly he means by "force." It is to this question that we must turn.