Mind, Body and the Laws of Nature in Descartes and Leibniz

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One of the central doctrines of Descartes's metaphysics was his division of the created world into two kinds of stuff: mental substance whose essence is thought and material substance whose essence is extension. And one of the central problems that later philosophers had with Descartes's doctrine was understanding how these two domains, the mental and the material, relate to one another. Descartes's solution was to claim that these two domains can causally interact with one another, that bodily states can cause ideas, and that volitions can cause bodily states. But this claim raises a number of serious questions. The most obvious problem arises from the radical distinction that Descartes draws between the two domains and from our difficulty in conceiving how two sorts of things so different could ever interact with one another. As the Princess Elisabeth complained to Descartes, ". . . it is easier for me to concede matter and extension to the mind than [it is for me to concede] the capacity to move a body and to be affected by it to an immaterial thing."[1] Though the story is complex, it is generally held that this problem led later in the century to the doctrine of occasionalism, in which the causal link between mind and body was held to be not a real efficient cause but an *occasional* cause. Thus, it was claimed, it is God who causes ideas in minds on the occasion of appropriate events in the material world and events in the material world on the occasion of an appropriate act of will.[2] The causal link between mind and body remains but is reinterpreted as an occasional causal link, a causal link mediated by God. But Descartes's interactionism raises another problem as well. For the seventeenth-century, the material world was thought to be governed by a network of physical laws. But, it would seem, if the material world is governed by law, then there can be no room for minds to act; if minds can be *either* the efficient *or* the occasional cause of changes in the material world, then, it would seem, physical laws must fail to hold in any system that contains animate bodies, bodies under the influence of minds.[3] Particularly vulnerable to such violations are the conservation laws, laws that stipulate that certain physical

quantities must remain constant over time, since it is difficult to see how a mind could influence the course of the material world, either by itself or with the intermediation of God, without altering *some* physical magnitude. Leibniz seizes upon just this feature of Descartes's position in an argument intended to persuade us to reject interactionism and accept his doctrine of pre-established harmony. Leibniz argues:

> M. Descartes wanted . . . to make a part of the action of the body depend on the mind. He thought he knew a rule of nature which, according to him, holds that the same quantity of motion is conserved in bodies. He did not judge it possible that the influence of the mind could violate this law of bodies, but he believed, however, that the mind could have the power to change the direction of the motions which are in bodies. . . . [But] two important truths on this subject have been discovered since M. Descartes. The first is that the quantity of absolute force which, indeed, is conserved, is different from the quantity of motion, as I have demonstrated elsewhere. The second discovery is that the same direction is conserved among all of those bodies taken together which one supposes to act on one another, however they may collide. If this rule had been known to M. Descartes, he would have rendered the direction of bodies as independent of the mind as their force. And I believe that this would have led him directly to the hypothesis of pre-established harmony, where these rules led me. Since beside the fact that the physical influence of one of these substances on the other is inexplicable, I considered that the mind cannot act physically on the body without completely disordering the laws of nature.[4]

Leibniz's argument is elegant and straightforward. The claim is that even though Descartes *thought* that he could reconcile the causal interaction of mind and body with the universality of physical law, he was mistaken. The true laws of nature block Descartes's solution, Leibniz argues, and lead us away from causal interactionism and directly to the hypothesis of pre-established harmony as the true account of the apparent relations that hold between the mental and the material.

In this paper, I shall explore this argument of Leibniz's in some detail. I shall begin with a careful exposition of the argument, sketching in some of the details of his position and Descartes's that Leibniz leaves out. I shall then examine the extent to which the position Leibniz attacks is the position that Descartes actually held and argue that Descartes's actual position allows him a plausible answer to Leibniz's attack on interactionism. In the end, I shall argue that the opposition between Cartesian interactionism and Leibnizian harmony is only a symptom of a much deeper difference, a difference between two opposing conceptions of the laws of nature and of the place of mind in the physical world.

1. MOTION, MOMENTUM, AND PRE-ESTABLISHED HARMONY

Cartesian physics is a physics of geometrical bodies, bodies all of whose properties are modes of extension, acting on one another through direct impact. Basic to such

a physics, of course, are the laws of motion and impact, the laws that govern the only kinds of change allowed in the world of material things. And basic to the laws of motion and impact for Descartes is his conservation law, derived directly from the activity of God. As Descartes wrote in his *Principia*:

> . . . God . . . in the beginning created matter along with motion and rest, and now, through His ordinary concourse alone, conserves just as much motion and rest in the whole of it [i.e., the material world] as He put there at that time. For although that motion is only a mode of moving matter, it has a certain determinate quantity which can easily be understood to remain always the same in the totality of things, even though it is changed in the individual parts. And so, for example, we believe that when one part of matter moves twice as fast as another, and the later is twice as big as the former, there is as much motion in the smaller as in the larger; and as much motion as is lost by one part slowing down is gained by another of equal size moving more quickly.[5]

Descartes's example suggests that his conservation principle can be summarized by a simple quantitative law: the total *quantity of motion*, as measured by the mass of each body multiplied by its speed, remains constant for the whole of the material world.[6]

It is tempting, but wrong, to assimilate Descartes's conservation law to the modern principle of the conservation of momentum. The conservation of momentum, a law that entered classical physics only later in the seventeenth century, holds that the total quantity of *momentum* remains constant, where momentum is understood as mass times *velocity* and where velocity is understood as a vector quantity, speed *and its direction*. Thus, the law of the conservation of momentum governs *both* the speed *and* the directions that bodies have. So, for example, if a body moving from right to left were to reverse its direction (because of a collision with another body, say), then the conservation of momentum would require that some other body or bodies (say, the body that had been hit) would have to begin moving at an appropriate speed from left to right in order to preserve the total momentum in the world.

Descartes's conservation law is quite a different matter, though. Basic to Descartes's physics is a strict distinction between the motion or quantity of motion a body has, and its *determination* as he calls it, roughly speaking, the direction in which that body is moving.[7] Now, even though this distinction between (quantity of) motion and determination does not explicitly appear in any statement of Descartes's conservation law, it is clear both from the lack of any mention of determination in that law and from the way Descartes actually applies the conservation law that it is meant to govern the *motion alone*. Thus, for example, when discussing impact, Descartes quite carefully separates out the two factors in the physical situation, using the conservation law *only* to determine the postcollision speeds of the bodies in question.[8] So, if in a system of bodies one body changes its direction, then, as long as it maintains its original speed, there is no change in the total quantity of motion; no compensatory change in the direction of another body is required to satisfy Descartes's law, as is the case with the conservation of momentum.[9] In holding that

the conservation law does not govern the directions in which bodies move, Descartes is not saying that direction is completely arbitrary. Both (quantity of) motion and direction are modes of body, and, as such, neither will change without an appropriate cause.[10] The point is just that whatever causes might result in changes in direction, such changes in direction are, by themselves, irrelevant to the law of the conservation of motion. One can alter the *directions* in which bodies in the world move as much as one likes, and as long as the *speeds* remain unchanged, the total quantity of motion will remain unaltered.

This feature of Descartes's conservation law opens an obvious possibility with respect to his account of mind-body interaction. Descartes clearly held that minds can cause events in the physical world. And it is also at least initially plausible to suppose, as Leibniz did, that Descartes wanted such interaction to take place without violating his conservation law. These two commitments can be easily reconciled, given the particular conservation law that Descartes adopted. If we suppose that mind acts on body by changing the *direction* in which some piece of matter is moving without changing its *speed*, then the problem is solved: mind can act on body without violating the conservation law. Mind can thus fit into the gap left open in Descartes's conservation law and help to determine what that law makes no pretense of governing. We will have to examine the textual evidence there is for attributing this line of reasoning to Descartes. But it is a position that he *could* have taken, and it is clearly the position that Leibniz thought that he *did* take.

However, it is just as clear that this is a position that Leibniz does not think Descartes is *entitled* to take. As the passage quoted above suggests, Leibniz's argument depends crucially on his refutation of Descartes's conservation law and its replacement by two somewhat different conservation principles. The arguments are complex, and a full examination of them would take us far beyond the scope of this paper. Put briefly, though, Leibniz was able to show that Descartes's conservation law has the absurd consequence that if it were the only law that bodies in motion were constrained to observe, then it would be possible to build a perpetual motion machine. More generally, he showed that in body-body interactions (collisions, for example) governed only by the principle of the conservation of quantity of motion, it is possible for the system to either gain or lose the ability to do work (the ability to raise a body of a given weight a given height, for example). This situation violates the principle of the equality of cause and effect, a metaphysical principle that, Leibniz held, governs this best of all possible worlds. According to that principle:

> The entire effect is equal to the full cause, and therefore, there is no mechanical perpetual motion, nor can a cause produce an active effect which can do more than the cause itself, but neither can there be an entire effect that can do less than the cause itself.[11]

Leibniz argues that if the equality of cause and effect is to be maintained, we must conserve not quantity of motion, mass time *speed*, but a different physical magnitude, living force (*vis viva*), which, he argues, is measured by mass times the *square* of the speed.[12] This new law is an improvement over Descartes's to be sure. But by

itself it does not seem to constrain directionality any more than Descartes's conservation law did. In a system of bodies, each of which is governed only by the conservation of living force, it *seems* as if one could change the directions of the bodies without changing the living force in the system. However, from this basic conservation law Leibniz is able to derive a second conservation law, a new law that constrains directionality in a way that Descartes's law does not.

Consider an aggregate of bodies in motion that constitutes a closed system, i.e., one in which no force is being added from the outside. This system contains living force in two different respects. First of all, each body in the aggregate has its own force, as measured by the mass of each body times the square of its speed. The sum of all of these individual forces is what Leibniz calls the "respective or proper force" of the aggregate. But in addition, the aggregate has what Leibniz calls "directive or common force . . ., that by which the aggregate can itself act externally."[13] This force is the force that the aggregate *considered as a whole* has, and it is measured by the *total* mass of the aggregate times the square of the speed of the *center of mass* of the aggregate. Now, just as the force in each individual body remains unchanged if nothing external affects it, so should the directive force of the aggregate remain unchanged if no force is added. But, Leibniz shows, this entails that *within* the aggregate any change in the direction of one body (through a collision with other bodies in the aggregate, say) must be compensated for by a change in the direction of some other body or bodies in the aggregate (say, the body or bodies hit), or else the speed of the center of mass of the aggregate as a whole will change, changing the directive force of the aggregate. Using reasoning like this, Leibniz establishes that if the total force of an aggregate is to be conserved, then not only must the respective force be conserved, the mass times the square of the speed of each individual body in the aggregate, but *also* the total quantity of *momentum*, mass times *velocity*, speed *and direction*! And since the universe as a whole constitutes such an aggregate, the conservation of momentum must govern the universe as a whole.[14] Thus, Leibniz argues, the principle of equality of cause and effect governs not only the *speeds* bodies have but their *directions as well*; a change in *either* the speed *or* the direction of a given body not compensated for by appropriate changes in other bodies is not permitted in the best of all possible worlds.[15]

This argument quite effectively blocks the reasoning that Leibniz attributed to Descartes. There is no room in Leibniz's conception of the material world for Cartesian minds to act. Cartesian interactionism is impossible without a violation of what were for Leibniz the basic metaphysical and physical laws that govern our world. This, Leibniz claims, led him and would have led Descartes, if he had grasped the true laws of nature, to reject interactionism and adopt the hypothesis of pre-established harmony. The hypothesis of pre-established harmony is, of course, one of Leibniz's proudest inventions. In its strictest formulation, it posits a perfect correspondence among the perceptions of all monads. As such, it is intimately connected with Leibniz's conception of the world as a collection of monads that are, by their nature, incapable of any genuine causal interaction.[16] But Leibniz also formulates the doctrine of pre-established harmony in a somewhat different way, a way that can be

understood, argued for, and adopted independently of Leibniz's idiosyncratic views about the ultimate nature of the world and the ultimate reduction of material bodies to well-founded phenomena grounded in a world of monads. In this version, the doctrine of pre-established harmony is less a claim about the interrelations among all created substances than it is a claim about two very special ones, the human mind and the human body. In its less rigorous formulation, the doctrine states simply that events in the mind and those in the body correspond to one another not because of any genuine causal link between the two, as Descartes held, and not because of the intervening action of God, as the occasionalists would have it, but because God, in the beginning, created mind and body independently of one another in such a way that there would always be an appropriate correspondence between what was going on in the one and what was going on in the other. As Leibniz succinctly summarized his theory:

> If we posit the distinction between mind and body, their union can be explained without the common hypothesis of influence, which cannot be understood, and without the hypothesis of occasional causes, which summons a *deus ex machina*. For GOD from the beginning so constituted both the mind and the body at the same time, with such wisdom and such skill that from the first constitution and essence of each, everything that comes about through itself in the one corresponds perfectly to everything that happens in the other, just as if [something] passed from the one into the other.[17]

This hypothesis, of course, deals neatly with the problem that had worried so many about how things as different as minds and bodies could be causally connected with one another. On Leibniz's theory they *aren't*. But, in this respect, Leibniz's theory is at best a small improvement over occasionalism, substituting one large divine labor in creating mind and body in harmony with one another for numerous lesser divine actions in coordinating the moment-by-moment states of the two. The deeper differences between pre-established harmony and occasionalist interactionism become clearer when we examine the problems raised by physical law. Although occasionalism addresses the problem of the *mechanism* of interaction, there is nothing in the occasionalist position that bears on the problem of interactionist violations of physical law. For the occasionalist, just as for the direct interactionist, every voluntary action would seem to violate some law of nature. Not so for Leibniz's pre-established harmony. If God can create a world in which events in minds and bodies can correspond with one another in an appropriate way without the necessity for either real or occasional causal links, He can also create things in such a way that this correspondence can take place without violating any of the laws that hold universally in the physical realm. Thus, Leibniz wrote:

> Minds follow their laws, which consist in a certain development of perceptions in accordance with goods and evils, and bodies also follow theirs, which consist in the laws of motion. But these two things entirely different in kind join together and correspond like two time-pieces perfectly well regulated to the same time, even though perhaps of entirely different construction.[18]

Or, even more graphically, Leibniz wrote to Arnauld:

> It is thus infinitely more reasonable and more worthy of God to suppose that He created the machine of the world from the beginning in such a way that without violating at any moment the two great laws of nature, those of force and direction, and instead in following them perfectly (excepting the case of miracles), it happens that the springs of bodies are ready to act of themselves, as is necessary, just at the moment that the soul has a volition, . . . and thus that the union of the mind with the machine of the body and the parts which it contains and the action of one on the other consists only in that concomitance which marks the admirable wisdom of the creator much better than does any other hypothesis.[19]

Given this particular statement of the doctrine, it is clear why Leibniz's reflections on mind-body interaction and physical law might have led him to pre-established harmony. Pre-established harmony seems to be an attractive way in which a dualist could account for the posited correspondence between acts of will in a nonmaterial mental substance and appropriate events in a nonmental body without violating any of the laws of nature that, Leibniz held, govern every event in the material world.

2. INTERACTION AND CONSERVATION IN DESCARTES

Leibniz's argument is an elegant one, a paradigmatic example of the interconnection between physics and metaphysics that characterizes rationalist science. And Leibniz seems to have focused on one of the central questions raised by any dualist interactionist philosophy of mind. Now, as a purely philosophical argument, Leibniz's attack on Descartes is worthy of serious consideration, to be sure.[20] But what interests me here is a somewhat more historical question: Is the position that Descartes actually held open to this kind of attack?

There is no question but that Descartes held the conservation law to which Leibniz alludes in his statement of the argument, and there is no question but that Descartes's law is wrong and the laws that Leibniz substitutes for it correct, at least within the world of classical physics. But Leibniz's attack on Cartesian interactionism makes at least one further assumption, the assumption that the laws of nature must, miracles aside, hold universally, without exception for all bodies in the material world, including animate bodies like our own. Leibniz certainly believed in the universality of natural law in this sense and attributed the same belief to Descartes, claiming that this commitment forced Descartes to hold that minds can change only the directions in which bodies move and not their speeds. But curiously enough, even though Leibniz was well versed in the Cartesian corpus, he refers to no passages from Descartes's writings to support those attributions. Nor could he have. For a close examination of Descartes's writings gives us good reason to believe that he never held the positions that Leibniz attributed to him, neither the change-of-direction account of mind-body interaction nor the universality of the laws of motion.[21]

Let us begin with the change-of-direction account of mind-body interaction.

The most striking evidence against the claim that Descartes held such a position is the simple fact that nowhere in what currently survives of Descartes's writings do we find anything like a clear statement of the account that Leibniz attributed to him; nowhere did he ever *say* that he held that minds can only change the direction in which bodies move. Typically when presenting his position he is content to assert simply that mind can cause motion in bodies. For example, Descartes wrote the following passage in a letter to the Princess Elisabeth in the context of an explanation of the primitive notion we have of the union of mind and body:

> . . . As regards mind and body together, we have only the notion of their union, on which depends our notion of the mind's power to move the body [*la force qu'a l'ame de mouuoir le corps*], and the body's power to act on the mind and cause sensations and passions.[22]

Similarly, Descartes wrote to Arnauld:

> Moreover, that the mind, which is incorporeal, can set a body in motion [*corpus possit impellere*] is shown to us every day by the most certain and most evident experience, without the need of any reasoning or comparison with anything else.[23]

And finally, consider a passage that Descartes wrote to Henry More:

> The force moving [a body] [*vis . . . mouens*] can be that of God Himself . . . or also that of a created substance, like our mind, or that of some other thing to which He gave the force of moving a body [*cui vim dederit corpus mouendi*].[24]

There is no mention of directionality in these passages. Descartes is content to say only that our minds have the ability to move our bodies. But these remarks are, admittedly, casual and were given in the context of nontechnical and almost off-the-cuff explanations of his position. However, it is significant that this casual lack of attention to the question of change of speed versus change of direction is also found in the strict and more technical accounts of mind-body interaction that Descartes gave.

Consider, for example, the discussion of interaction that Descartes gives in the *Passions de l'Ame*, a sort of auto-mechanic's manual for the mind-body union, where Descartes outlines in rather specific ways the nuts and bolts of how the mind acts on the part of the body to which it is most directly connected, the pineal gland.[25] Some of Descartes's most careful discussions of the direct action of the mind on the pineal gland there do indeed suggest that at least *sometimes* the mind acts on the human body by changing the direction in which the pineal gland is moving. Thus, Descartes writes in the *Passions* that "when the mind wants to remember something, this volition makes the gland incline successively in different directions [*vers divers costez*]."[26] Similarly, in talking about the opposition between the mind and the animal spirits, a bodily substance also capable of moving the pineal gland and, in so doing, causing both passions and involuntary movement of the body, Descartes notes that the pineal gland "can be pushed in one direction [*poussée d'un costé*] by the mind, and

in another by the animal spirits."[27] But there is nothing to suggest that the *only* way that the mind acts in the pineal gland is by changing the direction of its motion. In the *Passions*, Descartes often says simply that the pineal gland "can be moved in different manners by the mind [*diversement meuë par l'ame*]" or that a volition of the mind can "make the small gland to which it is closely joined move in the manner [*façon*] that is required to produce the effect which corresponds to that volition."[28] These passages suggest that the mind can alter the state of the pineal gland in ways other than by changing its direction.

Descartes's casual talk of mind simply moving body, both in strict and technical writings and in looser, nontechnical writings, together with the lack of any clear positive statement of the change-of-direction account is evidence enough against Leibniz's attribution. But, in addition, there are some passages among Descartes's writings whose sense *seems* to run directly contrary to the account that Leibniz attributes to Descartes. Consider, for example, some passages of the *Passions* in which the mind is said to act on the pineal gland in ways that appear difficult to reconcile with the change-of-direction account of interaction. Descartes discusses in the *Passions* the circumstance in which the animal spirits are moving the gland in such a way as to cause in the mind a desire for something that the mind wants to avoid, as, for example, when the animal spirits, stirred up by the sight and smell of a glass of fine wine, cause the gland to move in such a way as to implant the passion of desire for the wine in the mind at the same time that the mind wills that the body abstain. Descartes analyzes this familiar situation as a struggle (*combat*) ". . . between the effort by which the [animal] spirits push the gland to cause the desire for something in the mind, and that by which the mind pushes it back by the volition it has to avoid that same thing."[29] Descartes gives a similar account of the conflict between the natural tendencies of the pineal gland and the volition of the mind in his account of how it is that we fix our attention: "Thus when one wants to hold one's attention to consider the same object for some time, this volition holds the gland inclined to the same side throughout that time."[30] In both of these passages, Descartes represents the mind as *resisting* the movement that the pineal gland would have, left to purely mechanical causes; our minds are *preventing* the gland from having motion that it would otherwise have. It is difficult to see how this can be reconciled with the change-in-direction account of mind-body interaction, and it seems unlikely that Descartes would have allowed such passages to creep into his most careful account of the mind's action on the pineal gland if he genuinely held the account that Leibniz attributed to him.

Or consider, for instance, the comparison that Descartes draws between the action of mind on body and the scholastic account of heaviness (gravity). According to that theory, at least as Descartes understood it, the heaviness of a body is taken to be a real quality, something real and distinct from the body itself that causes the body to move toward the center of the earth.[31] Although Descartes rejects this account of heaviness in favor of a purely mechanical account of the phenomenon in terms of the laws of motion and impact and the size, shape, and motion of the particles that make up the heavy body and its ambient medium, the scholastic theory, still familiar

in his day, was of some use to Descartes in explaining his own account of mind-body interaction. For, Descartes claims, if one can understand the scholastic account of heaviness, then one ought to be able to understand how an immaterial substance can cause changes in a material substance. Thus, Descartes wrote to Arnauld:

> Many philosophers who think that the heaviness of a stone is a real quality distinct from the stone believe that they understand well enough how such a quality can move the stone toward the center of the earth, since they think that they have a manifest experience of it. I, who have persuaded myself that there is no such quality in nature, nor thus is there any true idea of it in the human intellect, believe that they use the idea which they have of incorporeal substance to represent that heaviness to themselves. Thus, it is no more difficult for us to understand how mind moves body than it is for them [to understand] how this heaviness bears a stone downwards.[32]

This example is intended to take away some of the mystery surrounding the question as to how a nonbodily thing can act on a body by giving an example of a nonbodily thing (the real quality of heaviness) that Descartes's contemporaries had no trouble accepting as a cause of motion. But this would be a curious example to use if Descartes thought that mind could change only the direction in which a body was moving. In the case of a body falling toward the center of the earth, there is no mere change in direction. Rather, the quality of heaviness is thought to produce *new motion* in the heavy body where there was none before. The implication is that mind acts on body in the same way.

This implication is clearest of all in another passage relating the action of mind on body to heaviness, this time comparing the action of mind on body not with the scholastic theory of heaviness but with Descartes's own theory. On Descartes's account of heavy bodies and free fall, the falling body is impelled downward toward the center of earth by means of collisions between that body and other smaller and more quickly moving bodies in the surrounding medium.[33] Thus he wrote in a passage, ironically enough, preserved only in a copy Leibniz made:

> If a body is pushed or is impelled to motion by means of a uniform force [*semper aequali vi*], of course imparted to it by mind (for there can be no such force otherwise), and if it is moved in a vacuum, then it would always take three times longer to travel from the beginning of the motion to the mid-point than from the mid-point to the end. However, there can be no such vacuum. . . . But suppose that the body were impelled by heaviness. Since that heaviness never acts uniformly like mind, but [acts by] some other body which already is in motion, it can never happen that a heavy body is impelled more quickly than that which moves it. . . .[34]

Descartes's main point in this passage is the contrast between the uniform acceleration due to the activity of mind, and the nonuniform acceleration due to heaviness. But it is clear from this passage that Descartes thought that the action of mind on bodies does *not* result in a mere change in direction. Rather, Descartes quite clearly

thought, mind can produce a real change in the *speed* of a body, in fact, that mind is the *only* natural means by which a uniform change in speed is *possible*.

It is, of course, *possible* that all of the passages I have presented can be reconciled with the change-of-direction thesis or that Descartes *thought* they could or that he actually rendered them consistent with that thesis in some now lost fragment, perhaps even one that Leibniz saw in Paris when Clerselier showed him Descartes's literary remains. But the passages I have cited, together with the lack of any clear and positive statement of the change-of-direction account in any of the numerous writings that do survive, make it likely that Descartes just did not hold the account of mind-body interaction that Leibniz attributed to him. At the very least, the burden of proof is on anyone who wants to claim that Leibniz's account of Descartes is correct.[35] This by itself leaves us in the dark about the relations between mind-body interaction and Descartes's conservation law, however. Even if Descartes did not hold the change-of-direction account of mind-body interaction, perhaps he had some other way of rendering interactionism consistent with a universal conservation law. Perhaps he would have argued that whenever a mind puts a body into motion, something somewhere else in the material world loses the requisite quantity of motion, so that mind serves only to redistribute motion in the world, for example.[36] Although such a move is open to Descartes, there is no textual evidence that he as much as considered it. The overwhelming impression that one gets from the texts is that Descartes just was not very concerned about reconciling his interactionism with his conservation law. Now, the apparent lack of attention to this problem may be explained in a number of ways. There is always the possibility that Descartes simply neglected to see the serious problem that his position raises. But there is another, better explanation for this apparent gap in Descartes's argument. The case can be made, I think, that, from Descartes's point of view, there just *is* no problem reconciling interactionism with the laws of nature. That is, there is reason to believe that Descartes may never have been committed to the position that his conservation law holds universally and may have allowed for the possibility that animate bodies lie outside the scope of the laws that govern inanimate nature.

Many versions of the conservation law do, indeed, suggest that the law is intended to hold universally. For example, when introducing the conservation law in the *Principia*, Descartes writes: ". . . God . . . in the beginning created matter along with motion and rest, and now, through His ordinary concourse alone, conserves just as much motion and rest in the whole of it as He put there at that time."[37] It is hard to see how God could conserve "just as much motion and rest" as He initially created if minds are allowed to add and subtract motion from the world literally at will. But when Descartes is being especially careful, he seems to allow that his conservation law may admit of some exceptions. As I will discuss in some detail below, Descartes's conservation law follows from the immutability of God. Thus Descartes writes just a few lines following the passage just quoted:

> Therefore, *except for changes [in quantity of motion] which evident experience or divine revelation render certain*, and which we perceive or believe to

> happen without any change in the Creator, we ought not to suppose that there are any other changes in His works, lest from that we can argue for an inconstancy in Him.[38]

Here Descartes clearly admits that there *can* be violations of the conservation law, circumstances in which motion is added or taken away. The reference to divine revelation suggests that some such violations might arise from miracles. But Descartes also makes reference to violations that "evident experience . . . renders certain." An obvious suggestion as to what Descartes has in mind here is the ability that the human mind has to set the human body in motion, which, as he told Arnauld, "is shown to us every day by the *most* certain and *most* evident experience."[39] This natural reading is confirmed a few pages later in the *Principia*, where Descartes is discussing his third law of motion, a law explicitly governed by the conservation law, in which Descartes sets out the general features of his account of impact. Descartes writes:

> And all of the particular causes of the changes which happen to bodies are contained in this third law, *at least insofar as they are corporeal*; for we are not inquiring into whether or how human or angelic minds have the force [*vis*] to move bodies. . . .[40]

This is, to be sure, something less than a clear and positive statement that minds can cause violations in the laws of nature. But, together with the lack of any attempt to reconcile interactionism with his conservation law, these passages suggest that in the *Principia* Descartes, at very least, left open the possibility that the activity of minds is not constrained by the laws of nature that hold for bodies.[41]

At this point we can return to the questions raised at the beginning of this section. The passages cited earlier strongly suggest that Descartes did not hold the change-of-direction account of mind-body interaction that Leibniz attributes to him. Even more radically, although the texts are not completely decisive on the question, they do suggest that Descartes at least left open the possibility that his conservation law may be violated by animate bodies. The philosophical point should be clear. Descartes *might* have answered Leibniz's attack on interactionism by simply denying that the conservation laws must hold for animate bodies. If this were Descartes's answer, as I suspect it would have been, then even if Leibniz were to convince him of the falsity of his own conservation law, Descartes would not have been forced to reject interactionism. There is no reason to think that Descartes would have held Leibniz's conservation laws to be any more universal than he seems to have held his own to be. And if Leibniz's conservation laws are not taken to govern the behavior of animate bodies, then they pose no obstacle at all to the claim that minds can alter the course of events in the material world.

3. GOD AND THE LAWS OF NATURE

In the previous section I outlined one answer that Descartes could have given to Leibniz's argument. I have claimed that, given what he says about mind-body interaction,

it is open to Descartes to deny the universality of physical law and to deny that animate bodies are constrained by the same laws that govern the purely material world. Thus, it seems, the difference between Descartes's interactionism and Leibniz's preestablished harmony comes down to a more basic difference with respect to the scope of physical law. This, however, raises still deeper questions. First of all, there is the question of the coherence of Descartes's own position. Is the position that the texts suggest consistent with Descartes's otherwise mechanistic world view? Can the exclusion of animate bodies from the laws of the material world be anything but arbitrary? And, second, there are arguments of Leibniz's to deal with. Leibniz took it for granted that the laws of nature apply to animate bodies. Are Leibniz's reasons for holding this position binding on Descartes as well? In the argument I presented at the beginning of this paper, Leibniz attempts to trace Descartes's interactionism to a relatively uncontroversial and straightforward mistake about the true laws of motion. The argument I offered in the previous section suggests that Leibniz's argument may not be applicable to the position that Descartes actually held. But Descartes's position may still rest on a mistake, a different mistake than the one that Leibniz attributes to him, to be sure, a mistake about the scope of physical law rather than its content, but a mistake nevertheless. We must, then, explore whether there is some unobjectionable way for Descartes to exclude animate bodies from the scope of physical law.

One place we might begin is with Descartes's discussion of the union of mind and body. In an interesting paper, the only discussion of this question that I know of in the literature, Peter Remnant attempts to link the exclusion of animate bodies from the laws of motion to the discussion of mind-body unity and interaction found in Descartes's celebrated correspondence with Elisabeth.[42] Remnant notes that for Descartes the world of created things is understood through three distinct primitive notions, the notions of extension, thought, and the union of mind and body. Descartes writes to Elisabeth that

> . . . there are in us certain primitive notions which are as it were models on which all our other knowledge is patterned. . . . As regards body in particular, we have only the notion of extension which entails the notions of shape and motion; and as regards soul in particular, we have only the notion of thought. . . . Finally, as regards soul and body together, we have only the notion of their union, on which depends our notion of the soul's power [*force*] to move the body, and the body's power to act on the soul and cause sensations and passions.[43]

These notions are primitive in the sense that they must be grasped one by one, apart from all other notions, and cannot be explicated in terms of one another. As Descartes wrote:

> If we try to solve a problem by means of a notion that does not apply, we cannot help going wrong. Similarly, we go wrong if we try to explain one of these notions by another, for since they are primitive notions, each of them can only be understood by itself.[44]

Thus, Remnant claims, "each of these primitive notions defines an autonomous sphere of knowledge."[45] We must understand mind in terms of its primitive notion and the laws that follow from it, and body in terms of *its* primitive notion and the laws that follow from it. And, most important, we must understand the animate body, the thing composed of the union of mind with body in terms of its primitive notion and the laws that follow from *it*. To impose the laws of inanimate matter on animate bodies, unions of mind and body, is for Descartes, on Remnant's reading, a basic mistake that can lead only to confusion and misunderstanding; it is an instance of attempting to apply one primitive notion (that of extension and the laws it obeys) to an object to which it does not apply. Thus Remnant concludes:

> On Descartes's view there is a system of principles which applies to all purely physical interactions among bodies (including most biological processes) and another system which describes intellectual processes. But there is also a third realm, that of animated bodies. Animated bodies can participate in purely physical interactions and when they do their behavior conforms to the laws of motion. . . . But when they are behaving *qua* animated the laws of motion do not apply to them—their behavior conforms to a different set of principles, falling under the primitive notion of the union of soul and body. . . . If all the activities of bodies consisted in animated behavior then the laws of motion would have no application; similarly, if all the activities of the soul involved its union with its body . . . the principles of intellection would have no application; it is only because bodies also behave purely *qua* bodies and minds purely *qua* minds that these two sets of principles have application. But this is consistent with the occurrence of another sort of behavior, subject to another set of principles, namely that of animated bodies.[46]

Remnant's account of the matter has the ring of truth. Descartes does, indeed, treat the union of mind and body *almost* as if it were a separate substance, and it is plausible to suppose that he thought of the animate body as satisfying different laws than the ones that inanimate bodies satisfy.[47] But this cannot be the *whole* story. Surely, *some* of the laws applicable to inanimate bodies are *also* applicable to bodies united to minds. Surely, the geometrical properties of the pineal gland are the same, whether that gland is connected to a mind or not. Surely, a living human being can no more be in two places at the same time than can a corpse. And surely, although the mind enables us to do much that cannot be done in inanimate nature, it does not allow us to create a vacuum in Descartes's world. Thus, even though animate bodies may be exempt from the laws of motion, there are many other laws that *all* bodies must obey, even those that are behaving *qua* animated, to use Remnant's phrase. And this raises a basic question: What specifically is it about the laws that govern motion that exempts the union of mind and body from their scope? Why are the laws that govern shape, for example, one mode of extension, greater in scope than the laws that govern motion, *another* mode of extension? The arbitrariness still remains on Remnant's account; there still seems no reason why Descartes can exclude animate bodies from the laws of motion. If there is any reason why animate

bodies can violate the laws that hold for inanimate nature, it must concern not only the doctrine of primitive notions that Descartes expounds to Elisabeth but also his conception of the laws of motion. And if there is any way that Descartes can sustain his position against Leibniz's claims, it must be found in the different accounts of those laws that the two philosopher-scientists offer. Thus, we must for the moment turn away from minds and bodies and investigate the ways in which Descartes and Leibniz treat the laws of motion.

For Leibniz, the laws of motion, like every other contingent feature of this world, are grounded in God. In particular, they are grounded in God's *ends*, in his decision to create the best of all possible worlds. Leibniz writes:

> . . . The true physics should in fact be derived from the source of the divine perfections. It is God who is the ultimate reason of things and the knowledge of God is no less the source of sciences [*principe des sciences*] than His essence and His will are the source of beings. . . . Far from excluding final causes and the consideration of a being who acts with wisdom, it is from these that everything must be derived in physics. . . . I agree that the particular effects of nature can and ought to be explained mechanically, though without forgetting their admirable ends and uses, which providence has known how to contrive. But the general principles of physics and mechanics themselves depend on the action of a sovereign intelligence and cannot be explained without taking it into consideration.[48]

Leibniz's physics, then, begins with a consideration of God as the *final* cause of the world. Leibniz's position is, of course, that God acts in accordance with the principle of perfection, that God chose our world from among an infinity of other possible worlds because it is the most perfect, the one that has the most order consistent with the greatest variety in phenomena. Now, the order that Leibniz attributes to the world God creates is complex and involves a number of important metaphysical principles. But among these principles are the laws of nature in general, and among the laws of nature are the laws of motion and the more general metaphysical principles on which they rest. Thus Leibniz wrote in the *Principles of Nature and Grace:*

> The supreme wisdom of God has made Him choose especially those *laws of motion* which are best adjusted and most fitted to abstract or metaphysical reasons. There is conserved the same quantity of total and absolute force, or of action; also the same quantity of relative force, or of reaction; and finally, the same quantity of directive force. Furthermore, action is always equal to reaction, and the entire effect is equivalent to its full cause. It is surprising that no reason can be given for the laws of motion which have been discovered in our own time . . . by a consideration of *efficient causes* or of matter alone. For I have found that we must have recourse to *final causes* and that these laws do not depend upon the *principle of necessity*, as do the truths of logic, arithmetic, and geometry, but upon the principle of fitness [*principe de la convenance*], that is to say, upon the choice of wisdom.[49]

The laws of motion, then, are intertwined with the order that God has imposed on our world as a consequence of His decision to create the best of all possible worlds.[50]

These basic laws governing nature are not without exception, though. God, acting in accordance with some higher principles of order, principles of supernatural order that, Leibniz thought, lie beyond our comprehension, can violate the laws that He set down for finite things to observe. As Leibniz wrote in the *Discourse on Metaphysics:*

> Now, since nothing can happen which is not according to order, it can be said that miracles are as much subject to order as are natural operations and that the latter are called natural because they conform to certain subordinate maxims which we call the nature of things. For we may say that this nature is merely a custom of God's with which He can dispense for any reason stronger than that which moved Him to use these maxims.[51]

However, it is important to note, such violations of the subordinate maxims that constitute the laws of nature are miracles, happenings that, Leibniz argues, must lie beyond the capability of finite beings to bring about if miracles are to be genuinely distinct from the ordinary course of nature. Thus Leibniz explained to Clarke:

> If a miracle differs from what is natural only in appearance and with respect to us, so that we call a miracle only that which we seldom see, there will be no internal real difference between a miracle and what is natural, and at the bottom every thing will be either equally natural or equally miraculous. Will divines like the former, or philosophers the latter? . . . In good philosophy and sound theology we ought to distinguish between what is explicable by the natures and powers of creatures and what is explicable only by the powers of the infinite substance. We ought to make an infinite difference between the operation of God, which goes beyond the extent of natural powers, and the operations of things that follow the law which God has given them, and which He has enabled them to follow by their natural powers, though not without His assistance.[52]

So, even though God can violate natural law for the sake of a higher order, for the sake of *supernatural* law, nothing in nature can. These subordinate laws govern nature as a whole and without exception, save for the extraordinary (and infrequent) interference of God.

This conception of natural law and its place in the order that God imposes on nature has important consequences for Leibniz's account of mind and its relation to body. By the argument sketched in section 1, if mind could act on body, either directly or through the intermediation of God, then bodies animated by rational minds would violate the laws that govern inanimate bodies. Now, such violations are by no means impossible, even if the laws that God imposed on matter are universal in scope and make no distinction between animate and inanimate matter. But, *if* God's laws are universal in that sense, as Leibniz almost always assumes, then *any* such violations would be *miraculous*, even if such violations occurred in an entirely lawlike and regular way. Thus Leibniz writes:

> . . . The common system [i.e., direct interactionism] has recourse to absolutely inexplicable influences, while in the system of occasional causes God is compelled at every moment, by a kind of general law and as if by compact, to change the natural course of the thoughts of the soul to adapt them to the impressions of the body and to interfere with the natural course of bodily movements in accordance with the volitions of the soul. This can only be explained by a perpetual miracle. . . .[53]

Though such a world of perpetual miracles is possible, Leibniz rejects such an account of the matter for both methodological and metaphysical reasons. Methodologically, the appeal to God that is required to account for the constant violation of natural law is an ad hoc appeal to a *deus ex machina* in quite a literal sense of the phrase. Leibniz writes:

> Problems are not solved merely by making use of a general cause [i.e., God] and calling in what is called the *deus ex machina*. To do this without offering any other explanation drawn from the order of secondary causes is, properly speaking, to have recourse to miracle. In philosophy we must try to give a reason which will show how things are brought about by the Divine Wisdom, in conformity with the notion of the subject in question.[54]

And metaphysically, the perpetual miracle that interactionism requires is objectionable insofar as it attributes an imperfection to God's work. Thus Leibniz writes to Clarke:

> But they who fancy that the soul can give a new force to the body, and that God does the same in the world in order to mend the imperfections of his machine, make God too much like the soul by ascribing too much to the soul and too little to God. For none but God can give a new force to nature, and He does it only supernaturally. If there was a need for Him to do it in the natural course of things, He would have made a very imperfect work.[55]

So, *if* the laws of motion that God decreed are universal and make no distinction between human being and stone, then order and perfection, not to mention good scientific method, require that we reject the hypothesis of interaction as miraculous. But, one might ask, how does Leibniz know that the laws of motion *are* universal? Surely, God *could* have set things up in such a way that animate bodies followed different laws than bare matter, so that it would be a *law of nature* that when a mind has an appropriate volition, the animate body to which it is attached is exempted from laws that otherwise govern its behavior. One might suggest, for example, that the laws of nature are hierarchical, as it were, that the laws of physics are dominated by the psychophysical laws of mind-body interaction in the same way that, for Leibniz, the totality of laws of nature are dominated by the supernatural laws that govern God's activity and in accordance with which He can suspend the laws of nature to satisfy higher laws.[56] What is wrong with such a conception of natural law? Although Leibniz usually takes the universality of physical law for granted, rarely arguing the point explicitly, Leibniz has an answer to this question. From Leibniz's

point of view, though such a hierarchical world is *possible*, such a world is less perfect than a world governed by pre-established harmony and, thus, would not have been created. Consider two possible worlds, ω_g, a world in which there is direct or occasional interaction, a world that thus embodies a hierarchy of "gappy" laws and a world ω_h that is governed by pre-established harmony, a world governed by universal and exceptionless laws. Suppose, first, that ω_g and ω_h contain exactly the same phenomena: sensation and bodily state, volition and action correspond in *exactly* the same way in each. But, despite the agreement on the phenomena, it is obvious that ω_h, the world of universal and exceptionless laws, is considerably simpler and more orderly than ω_g, the world governed by the hierarchy of gappy laws.[57] So, from Leibniz's point of view, ω_h must be preferable to ω_g. But what if ω_g and ω_h *differ* in the variety of their phenomena? One might argue, in fact, that they *must* differ in *some* phenomena if they are to have genuinely different laws. Here the argument is more difficult. But, even in this case, Leibniz seems to hold that ω_h is the more perfect world. Leibniz's position is that simplicity is more important than variety of phenomena, so that even if the variety of phenomena in ω_g were greater than that in ω_h, the simplicity of the laws in ω_h would tilt the balance in favor of that world. The argument I have sketched is presented most explicitly in a passage from the *Theodicy*. Leibniz writes:

> Thus, it is necessary to judge that among the general rules which are not absolutely necessary, God chooses those which are the most natural, those which are the easiest to account for and which also serve to account for other things. This is doubtless most beautiful and pleasing, and were the system of *pre-established harmony* not otherwise necessary to eliminate superfluous miracles, God would have chosen it, since it is the most harmonious [system]. *The ways of God are the most simple and the most uniform: they are to choose the rules which limit one another least*. They are also the most *fruitful* with respect to the *simplicity of means*. . . . One can, indeed, reduce these two conditions, simplicity and fruitfulness, to a single advantage, which is to produce as much perfection as is possible. . . . But even if the effect were supposed greater, but the means less simple, I think that one could say that all and all, the effect itself would be less great, counting not only the final effect but also the mediate effect. Thus those who are wisest act, as much as possible, so that the means are, in a way, ends as well, that is to say, desirable not only for what they *do*, but for what they *are*. Complicated ways occupy too much ground, too much space, too much place, too much time that could have been better used.[58]

Leibniz thus concludes that the doctrine of pre-established harmony, in which the laws that govern bodies and the laws that govern minds "limit one another least," is "infinitely more reasonable and worthy of God"[59] than is any variety of interactionism. Leibniz's principle of perfection, the principle in accordance with which God creates the best of all possible worlds, demands that the laws that God decrees for inanimate nature hold for human beings as well. Human beings, complex bodies animated by rational minds, must, by the principle of perfection, be an integral

part of the world of finite things governed by the simple and uniform principles that God decrees as the laws of nature, principles that only *He* can violate, principles whose violation can only be miraculous. And if the scope of natural law is to include human beings as well as tables, chairs, and potted palms, then, unless we are willing to embrace the odious hypothesis of perpetual miracle, interactionism of any sort must be out of the question.

Leibniz's position on the scope of physical law is, thus, grounded in some of his most basic metaphysical commitments, the connection between perfection and order and the principle that God creates the best of all possible worlds. Because of these principles, Leibniz must hold that the laws of nature are universal, and because of these principles, supplemented with some commonsense scientific methodology, Leibniz must reject the perpetual miracles that interactionism entails for him. But, for all that, Leibniz's position is by no means invulnerable. There are, to be sure, any number of gaps in Leibniz's arguments that a clever Cartesian might well be able to exploit in defense of a more limited scope for physical law and in support of an interactionist dualism. One might, for example, point out the ad hoc way in which Leibniz favors order over variety of phenomena in arguing for pre-established harmony over its alternatives. But Descartes himself would have found Leibniz's claims vulnerable to attack on the most basic level. The considerations of perfection, order, and God's ends in constructing the best of all possible worlds, considerations that lead Leibniz to include animate bodies within the scope of the laws of physics, and that lead him from interactionism to pre-established harmony, would have moved Descartes little, if at all. For Descartes, the immensity and incomprehensibility of God preclude *any* appeal to such reasoning to establish the laws that govern the material world. Thus Descartes wrote in response to Gassendi:

> Although in Ethics, where it is often permissible to use a conjecture, it is sometimes pious to consider what end we can conjecture for God to have set out for Himself in ruling the universe, this is certainly out of place in Physics, where everything ought to shine with the firmest reasons. Neither can we pretend that some of God's ends are better displayed to us than others; for all [of God's ends] are hidden in the same way in the abyss of His inscrutable wisdom.[60]

In fact, given Descartes's radical voluntarism with respect to the eternal truths, God *has* no aims or goals, strictly speaking. His volitions are free with a freedom of complete indifference. God did not set out to create the world that would be the most perfect; God did not create this world *because* it is the most perfect one. Rather, it is the most perfect one because God created it.[61]

The rejection of final causes in physics marks a basic difference between Cartesian and Leibnizian physics. But this does not mean that Descartes rejects Leibniz's grounding of physics in the activity of God or Leibniz's claim that true knowledge of the physical world must be derived from our knowledge of God. Neither does it mean that the laws of physics are inaccessible to rational argument or demonstration. Rather, Descartes claims, they are to be derived not from God as a *final* cause but from God as an *efficient* cause. Thus he wrote:

> And finally, we shall not seek the reasons for natural things from the ends which God or nature propose for themselves in making them, since we ought not to be so arrogant as to think that we participate in their counsels. But considering Him as the efficient cause of everything, we must see what can be concluded from those attributes of which He allows us some notion, about those of His effects which the senses make apparent to us, by means of the light of nature which is innate in us.[62]

The laws of nature, then, are to be derived not from considerations of order, perfection, and God's ends in creating this world, as they are for Leibniz, but from His nature and the way in which He operates in the world. The laws of nature are not *chosen* by God and *imposed* on the world. Rather, they follow directly from the *way* in which God acts on the world. To use a distinction familiar from recent moral theory, whereas Leibniz's God is a teleologist, acting for the *end* of order and perfection, Descartes's God is a deontologist, doing the *right thing* from moment to moment, whatever might come of it. Consequently, for Descartes, one cannot appeal to order and perfection to justify one conception of the world over another.

This strategy for deriving the laws of nature is apparent in the argument that Descartes offers for his conservation law. The law is presented in the context of a discussion of the "universal and primary" cause of motion, that which is the "general cause of all motions which are in the world." This general cause is, of course, "none other than God Himself," who

> . . . in the beginning created matter along with motion and rest, and now, through His ordinary concourse alone, conserves just as much motion and rest in the whole of it [i.e., the material world] as He put there at that time. . . . We also understand God to be perfect not only insofar as He is, in Himself, immutable, but also in that He works [*operetur*] in as constant and immutable a way as possible. Therefore, except for those changes [in quantity of motion] which evident experience or divine revelation render certain, and which we perceive or believe to happen without any change in the Creator, we ought not to suppose that there are any other changes in His works, lest from that we can argue for an inconstancy in Him.[63]

The precise intuitions behind Descartes's proof are illuminated by other passages in which Descartes discusses the operation of God in the world. Descartes notes that the nature of time is such that:

> . . . its parts do not depend upon one another, and never exist simultaneously; and therefore from the fact that we exist now, it does not follow that we will also exist in the next following time unless some cause, indeed the same one which produced us at first, continually re-creates us, that is, conserves us.[64]

Thus, Descartes claims, God must continually re-create the world at every moment, or else it would pass into nonexistence. This provides an obvious way of seeing how God's immutability results in the conservation law for Descartes. Descartes argues: ". . . [God] conserves [motion] just as it is at the moment in which it is being

conserved, without regard to what it was a bit before."[65] God's immutability requires that when He re-creates the world from one moment to the next, He must re-create it as much as possible as it was the previous moment. In part, He must re-create the world with the same quantity of motion it had the moment before.

In this argument Descartes is quite explicitly following the strategy he set out for deriving "reasons for natural things." He is considering God as an *efficient* cause, the cause of motion in the beginning, and the continuing cause of motion in the moment-by-moment conservation of the world.[66] He then considers God's attributes, the fact that God's perfection involves constancy of operation and argues from that to the conservation law. Descartes's reasoning is not without its problems here. The derivation is obscure, complex, and the conclusion ultimately wrong, as Leibniz successfully showed. But it is the strategy that I am interested in here, what Descartes thought he was doing, and that is clear enough. The conservation law for Descartes is not a law that God imposes on the world to further some end; it is intended to be a consequence of the constraints that God's nature imposes on God as an efficient cause of motion in the material world.

Descartes's conception of the conservation law and its ground in the immediate activity of God has important consequences for the way in which he conceives of mind in the context of the order of nature. The conservation law is, for Descartes, a law that follows out of the way in which God acts as an efficient cause of motion. As an efficient cause of motion, He must, by virtue of His nature, act in such a way as to preserve the same quantity of motion from moment to moment. But, Descartes says, although God is the "universal and primary" cause of motion,[67] He is not the *only* cause. As he wrote to More:

> The translation which I call motion, is a thing of no less entity than shape: it is a mode in a body. The force moving [a body] can be that of God Himself conserving the same amount of translation in matter as He put in it in the first moment of creation; or also [it can be] that of a created substance, like our mind, or that of some other thing to which He gave the force of moving a body.[68]

Now, when God causes motion, the motion He causes must observe the conservation law. But there is no reason at all to impose similar constraints on *finite* and *imperfect* causes of motion. That is, though finite, imperfect minds may act in some lawlike way, deriving from their finite and imperfect natures, the motion *they* cause need not satisfy the conservation principle. *They* may add or subtract motion from the world, even if *God* cannot. To suppose that they do argues for no change in God Himself and does not give us grounds for imputing an "inconstancy in Him."[69] Thus, it seems, there is nothing arbitrary or inconsistent with Descartes's principles to suppose that animate bodies, bodies capable of being acted upon by minds, can violate the conservation principle. Such bodies stand, as it were, outside of the world of purely mechanical nature. The conservation principle governs only *purely material* systems in nature, systems in which God is the *only* cause of motion.[70]

It should be clear by now that Descartes's interactionism rests on no simple mistake, either about the content or the scope of physical law. Because of his general

rejection of final courses in physics, he has a defense against the arguments from the principle of perfection that lead Leibniz to pre-established harmony.[71] And because of his conception of the laws of motion as deriving from the action of God as an efficient cause of motion, Descartes can exempt animate bodies from the laws that govern inanimate bodies in motion in a coherent and nonarbitrary way and allow mind to affect the behavior of body. Descartes's interactionism thus rests reasonably secure against Lebniz's attack. This is an interesting conclusion in and of itself. But, I think, the defense I have sketched gives something even more interesting, an insight into the real differences that separate Descartes's and Leibniz's positions. What forces Leibniz to reject interactionism and to adopt pre-established harmony is the fact that for him mind is an *integral part* of a world governed by principles of order, overarching metaphysical principles decreed by a wise and benevolent God. In Leibniz's best of all possible worlds, simplicity and tidiness dictate that the laws of nature that God decreed must, miracles aside, govern all bodies, both animate and inanimate, thus ruling out any variety of interactionism. For Descartes, though, the wisdom of God is beyond our reach; simplicity and order are just not at issue. The laws of motion are not, for Descartes, principles of order that God imposes on the world but, rather, a direct consequence of the laws that God Himself obeys as one of a number of possible causes of motion in the world. Because mind is a cause of motion that lies *outside* the scope of the laws that govern God's activity, Descartes can maintain his interactionism in spite of Leibniz's argument. What explains Leibniz's rejection of interactionism, then, can be no simple discovery that Descartes's conservation law is wrong, as Leibniz seems to have believed. Rather, what separates Leibniz's account of the relation between mind and body from Descartes's is something much deeper and more significant, a change in the place of mind in the natural order of things, a change motivated by a fundamental shift in the very conception of what a law of nature is and how it derives from God.[72]

Abbreviations

Books and Collections

AT Adam, C., and Tannery, P. (eds.), *Oeuvres de Descartes* (Paris: 1897–1910 and 1964–1978).

C Couturat, L. (ed.), *Leibniz: Opuscules et Fragments Inédits* (Paris: 1903).

G Gerhardt, C. I. (ed.), *Leibniz: Philosophischen Schriften* (Berlin: 1875–1890).

GM Gerhardt, C. I. (ed.), *Leibniz: Mathematische Schriften* (Berlin: 1849–1855).

HR Haldane, E. S., and Ross, G. R. T. (eds. and trans.), *Philosophical Works of Descartes* (Cambridge: 1911).

K Kenny, A. (ed. and trans.), *Descartes: Philosophical Letters* (Oxford: 1970).

L Loemker, L. (ed. and trans.), *Gottfried Wilhelm Leibniz: Philosophical Papers and Letters*, 2nd ed. (Dordrecht: 1969).

M Mason, H. T. (ed. and trans.), *The Leibniz-Arnauld Correspondence* (Manchester: 1967).

NE Langley, A. G. (ed. and trans.), *Leibniz: New Essays Concerning Human Understanding* (La Salle, Ill.: 1949).

Individual Works

DM Leibniz, *Discours de Métaphysique*. Found in G IV 427–63 and translated in L 303–28.

Mon. Leibniz, *Monodologie*. Found in G VI 607–23 and translated in L 643–52.
PA Descartes, *Les Passions de l'Ame*. Found in AT XI 291–497 and translated in HR I 331–427.
Pr Descartes, *Principia Philosophiae*. Found in AT VIII A (Latin version) and AT IX B (French translation). Partial translation into English is in HR I 203–302. Quotations are taken from the Latin version.
Theod. Leibniz, *Essais de Theodicée*. Found in G VI 21–471.

References to books and collections are given by volume (when appropriate) and page. References to individual works are given by part (in the case of Pr) and section number. Original language citations are given first, followed by an English translation in parentheses when available.

Notes

1. AT III 685.

2. The most prominent adherent of this position is, of course, Nicholas Malebrance. See his *The Search after Truth and Elucidations of the Search after Truth*, ed. and trans. by Thomas Lennon and Paul J. Olscamp (Columbus, Ohio: Ohio State University Press, 1980), pp. 446–52 and 657–85; or *Dialogues on Metaphysics* ed. and trans. by Willis Doney (New York: Abaris Books, 1980), pp. 144–69.

3. In this paper, the term 'animate body' will be used to designate any body related in an appropriate way to a mind or soul, as, for example, the human body is for both Descartes and Leibniz. This has the unfortunate consequence that on my somewhat special use of the term Cartesian animals must be considered inanimate. But I could find no more natural way of designating the special class of bodies with which I will be concerned in this paper.

4. Theod. 60–61. See also Mon. 80; G II 94 (M 117–18); G III 607 (L 655); G IV 497–98; G VI 540 (L 587). The argument in these passages concerns only the mental causation of physical events. Consequently, I will not discuss in this paper the problems raised by the physical causation of mental events.

5. Pr II 36. The conservation law is first stated in the ill-fated *Le Monde*. See AT XI 43.

6. This is the standard reading of Descartes's law. It should be noted that my use of the term 'mass' here is anachronistic. Although it helps one to see the relations between Descartes's incorrect law and later conservation principles, such as Leibniz's, Descartes himself would have given his law in terms of 'size' rather than 'mass'. For a discussion of some of the further intricacies in interpreting Descartes's conservation law, see Pierre Costabel, "Essai critique sur quelques concepts de la mécanique cartésienne." *Archives internationales d'histoire des sciences*, Vol. 20 (1967), pp. 235–52, esp. pp. 240–51. None of these questions of interpretation are relevant to the use Leibniz makes of Descartes's conservation law in the argument under discussion, though.

7. The distinction is most clearly drawn in Pr II 41. Once again, this is the standard reading. Though it is sufficient for our purposes here, Descartes's notion of determination is much more complex than the simple equation of determination and direction would suggest. On this, see Pierre Costabel, *op. cit.*, 236–40; J. Ohana, "Note sur la théorie cartésienne de la direction du mouvement," *Les Etudes philosophiques*, Vol. 16 (1961), pp. 313–16; Ole Knudsen and Kurt Pedersen, "The Link between 'Determination' and Conservation of Motion in Descartes' Dynamics," *Centaurus*, Vol. 13 (1968–1969), pp. 183–86; A. I. Sabra, *Theories of Light from Descartes to Newton* (London: Oldbourne Press, 1967), pp. 116–27; and Alan Gabbey, "Force and Inertia in the Seventeenth Century: Descartes and Newton," in Stephen Gaukroger (ed.), *Descartes: Philosophy, Mathematics and Physics* (Sussex: Harvester Press, 1980), pp. 230–320, esp. pp. 248–61.

8. See, e.g., Pr II 41; AT IV 185–86; AT VI 94, 97.

9. This is exactly the situation envisioned in Descartes's infamous fourth rule of impact, given in Pr II 49. According to that rule, if C is larger than B and if C, at rest, is hit by B, then B will reverse its direction and rebound from the collision with exactly the speed with which it

originally approached C. Strictly speaking, though, even this very simple case would require innumerable changes in the speeds and directions of other bodies in the system, since the Cartesian world is a plenum.

10. See Pr II 41; AT III 75; AT IV 185; AT VI 94, 97.

11. GM VI 437. See also G III 45–46.

12. This argument is implicit in the critique of Descartes's conservation law given in Leibniz's important "Brief Demonstration of a Notable Error in Descartes . . ." of 1686, the first of Leibniz's mature publications in physics. The text of this is given with a later appendix in GM VI 117–23 (L 296–302). For other presentations of the same basic argument, see, e.g., DM 17, G IV 370–72 (L 393–95); GM VI 243–46 (L 442–44); GM VI 287–92; etc. For discussions of the argument, see, e.g., Carolyn Iltis, "Leibniz and the *Visa Viva* Controversy," *Isis*, Vol. 62 (1971), pp. 21–35; George Gale, "Leibniz' Dynamical Metaphysics and the Origin of the *Vis Viva* Controversy," *Systematics*, Vol. 11 (1973), pp. 184–207; and Martial Gueroult, *Leibniz: Dynamique et Métaphysique* (Paris: Aubier-Montaigne, 1967), pp. 28–34.

13. For the distinction between these two kinds of force, see GM VI 238–39 (L 439); GM VI 462; GM VI 495.

14. The theorem is stated in numerous places. See, e.g., Theod. 61; G II 94 (M 117–18); G IV 497–98; GM VI 216–17 (NE 658); GM VI 227 (NE 667). A detailed argument is given in the *Dynamica*, GM VI 496–500. The crucial lemmas are given on GM VI 440, where Leibniz argues that "the same power [*potentia*] remains in any system of bodies not communicating with others" and concludes that, since the universe is such a system, "the same power always remains in the universe." This kind of argument is somewhat problematic for Leibniz when applied to momentum, since it is difficult to see what sense he could make of the speed of the center of mass of the universe as a whole. It should be noted that 'momentum' is not Leibniz's term for the quantity at issue. Leibniz uses a number of terms, sometimes 'quantity of *nisus*' (GM VI 462), sometimes (quantity of) 'progress' (GM VI 216–17 [NE 658]; GM VI 227 [NE 667]) but most often 'direction,' 'total direction,' or the like (Theod. 61; Mon. 80; G II 94 [M 117–18]; G III 607 [L 655]; G VI 540 [L 587]; G IV 497; etc.).

15. It *seems* as if this general kind of argument could have been used *directly* against Descartes's conservation law to show that it, too, ought to govern directionality and not just speed. Thus, Leibniz's replacement of quantity of motion by *vis viva* as the physical magnitude conserved is not, strictly speaking, relevant to the argument against interactionism.

16. This conception of the doctrine of pre-established harmony is found in G I 382–83; G II 68–70 (M 84–86); G IV 518 (L 493); G VII 412 (L 711–12).

17. C 521 (L 269). For other statements of this version of pre-established harmony, see, e.g., DM 33; G II 57–58 (M 64–65); G II 112–14 (M 144–46); G IV 483–85 (L 457–58); G IV 498–500 (L 459–60); G IV 520 (L 494); G VII 410–11 (L 710–11); etc.

18. G VI 541 (L 587).

19. G II 94–95 (M 118). See also Mon. 78; Theod. 62; G II 71 (M 87); G II 74 (M 92); G II 205–6; G IV 484 (L 458); G IV 559–60 (L 577–78); G V 455 (NE 553); G VI 599 (L 637); G VII 412 (L 712); G VII 419 (L 716–17). These passages make it evident just how deeply Leibniz was influenced by the materialism of Hobbes and the dual aspect theory of Spinoza. In these passages, Leibniz emphasizes that *every* event in the material world has an explanation in terms of the laws of physics alone.

20. For the classic examination of this objection to dualist interactionism from a purely philosophical point of view, see C. D. Broad, *Mind and Its Place in Nature* (London: K. Paul, Trench, Trubner and Co., 1925), pp. 103–9.

21. Although not generally recognized, this feature of Cartesian thought has been pointed out from time to time, only to be forgotten and then rediscovered by successive generations of scholars. On this, see Octave Hamelin, *Le Système de Descartes* (Paris: Librairie Félix Alcan, 1911), pp. 372–73; Jean Laporte, *Le Rationalisme de Descartes* (Paris: Presses Universitaires de France, 1950), pp. 245–48; Norman Kemp Smith, *Studies in the Cartesian Philosophy* (London:

Macmillan, 1902), p. 83 n.2; Geneviève Rodis-Lewis (ed.), *Descartes: Passions de l'Ame* (Paris: J. Vrin, 1970), p. 92 n.1. The most recent rediscovery is in Peter Remnant, "Descartes: Body and Soul," *Canadian Journal of Philosophy*, Vol. 9 (1979), pp. 377–86. Needless to say, there is substantial overlap between my argument in this section and the arguments presented in the other commentaries cited. However, the continued unfamiliarity of this point plus the new bits of evidence I have found make it worthwhile to review the case for this interpretation once again.

22. AT III 665 (K 138).

23. AT V 222 (K 235).

24. AT V 403–4 (K 257). This passage will be discussed in greater detail below.

25. On the direct connection between the mind and the pineal gland, see, e.g., PA 31; AT VII 86; AT XI 176–77, 183. It should also be noted that, in addition to the direct connection between mind and body, Descartes also holds that by virtue of being *directly* connected to the pineal gland the mind is *indirectly* connected to the human body as a whole. See, e.g., PA 30. Margaret Wilson sees these as two opposing conceptions of mind-body unity. See her *Descartes* (London: Routledge and Kegan Paul, 1978), pp. 204–20. I see the two conceptions as perfectly consistent and, in fact, complementary, as their juxtaposition in PA 30–31 suggests. Though I quote exclusively from the PA in discussing the action of the mind on the pineal gland, Descartes also discusses this question in the earlier *Traité de l'Homme*. But the discussions there are much less useful for our purposes. Most of the discussions that deal with the pineal gland deal with its role in sensation. See, e.g., AT XI 143–46, 176–77, 181, 183. And when volition is discussed in *l'Homme*, Descartes gives almost no detail as to how the mind actually manipulates the pineal gland. See, e.g., AT XI 131–32, 179.

26. PA 42.

27. PA 47.

28. PA 34, PA 41. See also PA 43.

29. PA 47. It is important to note here the distinction between the passion of desire and a volition, an act of the will, a distinction that is ignored in the translation of this passage given in HR I 353.

30. PA 43.

31. For a discussion of the scholastic theory of gravity and Descartes's rejection of it, in the context of his rejection of substantial forms, see Etienne Gilson, *Etudes sur le Rôle de la Pensée Médiévale dans la Formation du Système Cartésien* (Paris: J. Vrin, 1930), pp. 141–90.

32. AT V 222–23 (K 235–36). See also AT III 667–68 (K 139); AT VII 441–42 (HR II 254–55).

33. For this account of heaviness and free fall, see, e.g., Pr IV 20. Matters are complicated by a somewhat different account of heaviness that Descartes offers in *Le Monde* and mentions later in the *Principia*, in accordance with which heaviness is due to the centrifugal force that pushes the small particles of the subtle matter turning quickly around the earth away from the center of the earth. On this account, heavy bodies are pushed to the center of the earth to take the place of the subtle matter that is receding, in accordance with Descartes's claim that there can be no vacuum. For this account, see AT XI 72–80 and Pr IV 23. It is not clear how these two accounts of heaviness are related to one another.

34. AT XI 629–30. This interesting passage comes from a manuscript entitled "Problemata," preserved only in a copy Leibniz had made. Though one must use these documents with some care, the passage seems unquestionably authentic. The (mistaken) formula for the acceleration of a body in a vacuum given a uniform force is uniquely Cartesian and appears in a number of documents as the law of free fall for heavy bodies from 1618 to 1629 and is mentioned as a law that Descartes once held in a letter of 1634. See AT X 75f, 219; AT I 71–73, 304–5. For an account of Descartes's struggles with the problem of free fall, see Alexander Koyré, *Galileo Studies* (Atlantic Highlands, N.J.: Humanities Press, 1978), pp. 79–94. Dating the fragment, though, is problematic. In this fragment, Descartes is clearly distinguishing the problem of acceleration given a uniform force from that of free fall. But until at least 1629 Descartes *identified* the two

problems. See AT I 71–73. This suggests that the passage dates from later than 1629. It is also unlikely that the passage dates from later than 1640, the last date in which we have evidence of Descartes worrying about the derivation of the laws of free fall. See AT III 164–65. But it is hard to date the fragment more closely than that. It *may* be associated with a letter of 1631 in which Descartes claims that "I can now determine the proportion by which a descending stone increases its speed, not *in vacuo*, but in this air" (AT I 231). But it could just as well be associated with a letter of 1637 in which Descartes asks Mersenne to excuse him from answering a question "concerning the retardation which the movement of heavy bodies receive from the air where they move," claiming that such an account involves his whole physics and is inappropriate for a letter (AT I 392). External factors suggest a third date from the mid-1630s. One fragment in the "Problemata" is dated 5 February 1635 and corresponds to material in the *Météores* of 1637. See AT XI 626.

35. This, of course, raises the question as to why Lebniz attributed the position to Descartes. The best conjecture is that the change-of-direction account of mind-body interaction was common among later Cartesians, and Leibniz just assumed that it must have been Descartes's position as well. Norman Kemp Smith (*op. cit.*, p. 83 n. 2) cites Clauberg in this connection. Alan Gabbey has also called my attention to a letter written after Descartes's death by Claude Clerselier, Descartes's friend, translator, and editor, in which Clerselier argues that mind can change only the direction in which bodies move but cannot add motion. See Clerselier to de la Forge, 4 December 1660, in Clerselier (ed.), *Lettres de Mr. Descartes*, Vol. III (Paris: 1667), pp. 640–46. I have not been able to examine Kemp Smith's citation. But it is interesting to note that in the letter Gabbey cites Clerselier does *not* explicitly attribute the change-of-direction account to Descartes. Furthermore, the grounds on which Clerselier advances the claim involve a significant departure from Descartes's thought on motion and determination. Clerselier's argument depends on the claim that to create a motion requires as much power as to create matter itself, whereas determination "*n'adjoûte rien de réel dans la Nature*" and can thus be manipulated by finite minds (Clerselier, *loc. cit.*, pp. 641–43). But this contradicts what Descartes wrote to Clerselier in a letter 15 years earlier, a letter that Clerselier published in Volume I of his edition of Descartes's correspondence. Descartes's wrote:

> It is necessary to consider two different modes in motion: one is the motion alone, or the speed, and the other is the determination of this motion in a particular direction, which two modes change with equal difficulty (AT IV 185).

Thus, the Clerselier letter of 1660 gives us no grounds for attributing the change-of-direction account to Descartes himself.

36. This, in essence, is Broad's response to the objection. See C. D. Broad, *op. cit.*, pp. 107–9.

37. Pr II 36.

38. *Ibid.* Emphasis added.

39. AT V 222 (K 235). Emphasis added.

40. Pr II 40. Emphasis added.

41. There is one passage in *Le Monde* that seems to contradict this interpretation. In Chapter VII of that work, after having given the laws of motion and having claimed that these laws suffice for an "*a priori* demonstration of everything that can be produced" in the new world that Descartes is building in *Le Monde* (AT XI 47), Descartes says:

> And finally, so that there will be no exceptions which prevent [such a priori demonstrations], we shall add to our assumptions, if it pleases you, that God will produce no miracles, and that the intelligences or rational minds, which we might assume below [in the *Traité de l'Homme*], will not disrupt the ordinary course of nature in any way (AT XI 48).

This *might* be read as a denial that God can perform miracles or that minds can interfere in the "ordinary course of nature" in any way. But given what Descartes says about mind-body

interaction elsewhere, it is more reasonable to read this as a simplifying assumption known to be false but helpful in simplifying the initial presentation of the mechanist world that Descartes intended to give in *Le Monde*.

42. See Peter Remnant, *op. cit.*

43. AT III 665 (K 138). Quoted in Remnant, *op. cit.*, p. 382.

44. AT III 665–66 (K 138). Quoted in Remnant, *op. cit.*, p. 383.

45. Remnant, *op. cit.*, p. 383.

46. *Ibid.*, pp. 384–85. Remnant, like most commentators, is too quick to trust Descartes's answer to Elisabeth here. On this point, see my essay, "Understanding Interaction: What Descartes should Have Told Elisabeth," forthcoming in a supplementary volume of the *Southern Journal of Philosophy*.

47. On the mind-body union as a substance distinct from mind and body, see, e.g., Geneviève Rodis-Lewis, *L'Oeuvre de Descartes* (Paris: J. Vrin, 1971), Vol. I, pp. 352–54, and the references cited in Vol. II, p. 543 n.29. Rodis-Lewis is quite correct to reject the claim that Descartes thought of the union of mind and body as a distinct substance, but Descartes's frequent use of the notion of "*substantial* union" in connection with the mind and body (AT VII 228 [HR II 102]; AT III 493 [K 127]; AT III 508 [K 130]; etc.) does suggest something of the sort.

48. G III 54–55 (L 353).

49. G VI 603 (L 639–40).

50. For a discussion of the contingency of the laws of nature in Leibniz, see Margaret Wilson, "Leibniz's Dynamics and Contingency in Nature," in P. K. Machamer and R. G. Turnbull, eds., *Motion and Time, Space and Matter* (Columbus, Ohio: Ohio State University Press, 1976), pp. 264–89; reprinted in R. S. Woolhouse, ed., *Leibniz: Metaphysics and Philosophy of Science* (Oxford: Oxford University Press, 1981), pp. 119–38.

51. DM 7. See also Theod. 207; G II 41 (M 44–45); G II 51 (M 57); G II 92–93 (M 115–16). Leibniz claims that the supernatural order that governs miraculous violations of the laws of nature is beyond our comprehension in DM 16 and in G III 353.

52. G VII 416–17 (L 715). See also G II 93 (M 116); G IV 520 (L 494). Leibniz sometimes also suggests a more epistemic definition of a miracle as "a divine act which transcends human comprehension." See C 508–9; G III 353.

53. G VI 541 (L 587). See also Theod. 207; G II 57–58 (M 65); G II 94 (M 117–18); G III 354. It should be noted that Leibniz recognizes a number of senses in which interactionism, particularly of the occasionalist variety, involves perpetual miracles. See M. Gueroult, *Malebranche* (Paris: Aubier-Montaigne, 1955–1959), Vol. II, pp. 241–53.

54. G IV 483–84 (L 457).

55. G VII 375–76 (L 689).

56. The position sketched here is Malebranche's. On the hierarchy of laws, see, e.g., Nicholas Malebranche, *Dialogues on Metaphysics*, ed. and trans. by Willis Doney (New York: Abaris Books, 1980), pp. 320–21. On the ability of the mind-body laws to cause suspensions of the laws of physics, see Nicholas Malebranche, *The Search after Truth and Elucidations of the Search after Truth*, ed. and trans. by Thomas Lennon and Paul J. Olscamp (Columbus, Ohio: Ohio State University Press, 1980), pp. 580–81, 594.

57. It is, of course, a commonplace observation in contemporary philosophy of science that *any* statement can be presented as a universal statement. But the distinction between universal and "gappy" laws is clear enough for our purposes here.

58. Theod. 208; emphasis added. The argument is also suggested in G II 94–95 (M 118) and G III 340–41.

59. G II 94 (M 118).

60. AT VII 375 (HR II 223). See also AT VII 55 (HR I 173).

61. See AT VII 432 (HR II 248). For Leibniz's remarks on this claim, see, e.g., DM 2.

62. Pr I 28. For Leibniz's comments on this, see, e.g., G IV 360–61 (L 387).

63. Pr II 36.

64. Pr I 21. See also AT VII 48-49 (HR I 168).

65. Pr II 39. See also the parallel passage in *Le Monde*, AT XI 44. The argument is somewhat more complex than the brief exposition I have given suggests. Since each moment is without duration, there can be no motion, strictly speaking, at any given moment, as Descartes fully realized. See, e.g., Pr II 39; AT II 215. What is preserved from one moment to the next, then, cannot be motion itself but the tendency or inclination to motion. And, Descartes would have had to have held, in order to preserve the tendency to motion from one moment to the next, God would have to create the moving body at a somewhat different place from one moment to the next if this tendency is ever to result in any *actual* motion. On the notion of momentary tendency to motion, Descartes's need for such a notion, and the problems it raises for his metaphysics, see, e.g., F. Alquié, ed., *Oeuvres Philosophiques de Descartes* (Paris: Garnier Frères, 1963-1973), Vol. I, p. 359 n. 1; Thomas L. Prendergast, "Motion, Action, and Tendency in Descartes' Physics," *Journal of the History of Philosophy*, Vol. 13 (1975), pp. 453-62; and Martial Gueroult, "The Metaphysics and Physics of Force in Descartes," trans. in Stephen Gaukroger, ed., *Descartes: Philosophy, Mathematics and Physics*, pp. 196-229. Gueroult's final judgment is that ". . . instantaneous moving force, the distinction between the instant of motion and the instant of rest, . . . pose[s] an insoluble problem for Cartesian metaphysics" (p. 222).

66. Peter Machamer argues that, whatever Descartes's intentions were, final causes inevitably creep into his derivation of the laws of nature. See his "Causality and Explanation in Descartes' Natural Philosophy," in P. K. Machamer and R. G. Turnbull, eds., *op. cit.*, pp. 168-99. Although I think that Descartes can be defended on this point, it is beyond the scope of this paper to do so. What is important in this context is simply how Descartes conceived of his enterprise.

67. Pr II 36.

68. AT V 403-4 (K 257). This position is not without its problems. This passage puts the activity of mind in causing motion on a par with that of God. But, surely, however minds cause motion, they do not do it as God does, by way of a continual re-creation. In fact, it seems difficult to see how the mental causation of motion could be reconciled with the continual re-creation picture at all. Malebranche seizes on exactly this problem, using it to push Descartes to occasionalism in the seventh of his *Dialogues on Metaphysics*. There is no reason to believe, though, that Descartes was aware of this difficulty with his position.

69. Pr II 36.

70. The precise wording in the letter to More quoted above ("the force . . . can be that of God Himself conserving the same amount of translation in matter as He put in it in the first moment of creation . . .") suggests a somewhat different conclusion than the one I have drawn. Read literally, it seems to say that what is conserved from moment to moment is *precisely* the quantity of matter that God put into the world at the beginning, implying that, even if minds could add motion in one moment, God would simply fail to preserve it in the next. If this were Descartes's position, then even though minds could, in a sense, cause motion, the motion would not persist; the conservation principle would govern all bodies, animate and inanimate, with the exception of momentary lapses. But there is no reason to attribute such a strange position to Descartes. The position that the literal reading of that sentence suggests is inconsistent with the account of God's continuous re-creation of the world given in the context of Descartes's derivation of the laws of motion, in accordance with which ". . . [God] conserves [motion] just as it is at the moment in which it is being conserved, without regard to what it was a bit before" (Pr II 39; see also AT XI 44). For God to destroy motion added by mind would require Him to "remember" how much motion there was at the beginning in deciding how much to create at the next moment. Given the central role that this conception of continuous re-creation plays in the derivation of the laws of motion, it seems most likely that Descartes's remarks to More are not meant to be read so literally.

71. There is reason to believe that Descartes may have been explicitly aware that there is some connection between the admission of final causes, the claim that God created the most perfect world, and a position much like Leibniz's pre-established harmony. In a remarkable but almost entirely unnoticed passage, Descartes wrote:

> It is a strong conjecture to affirm anything which, if assumed, would make God understood as being greater or the world as being more perfect: as, for example, that the determination of our will to local motion always coincides with a corporeal cause determining motion; that miracles are always consistent with natural causes, etc. (AT XI 654).

The passage is found in a series of gleanings from Descartes's manuscripts preserved among Leibniz's papers. This portion of the manuscript is entitled "Annotations which Descartes seems [*videtur*] to have written in [or, on] his *Principia Philosophiae*" and may, I suspect, have been marginalia in Descartes's own copy. For a brief account of the manuscripts and their history, see AT X 207–10. The remark quoted is the second in a series of discrete paragraphs. The paragraph preceding the quote can plausibly be read as a comment on Pr I 26, and the paragraphs succeeding the quote link up naturally with Pr I 30, Pr I 30, Pr I 31, Pr I 33, Pr I 37, and so on in order. This suggests that the text quoted may well be a comment on Pr I 28, a passage quoted above in which Descartes explicitly rejects the appeal to God's purposes in particular and final causes in general. This, in turn, suggests that Descartes thought that *if* his structures against final causes were lifted, then pre-established harmony would be a reasonable position to adopt. Although this passage indicates that Descartes may have been aware of *some* connection between a version of pre-established harmony and the appeal to God as the creator of the best of all possible worlds, it gives us no reason to believe that Descartes was aware of the full position, as Leibniz develops it, nor does it give us any indication as to how *precisely* Descartes saw the connection between the claim that the world is perfect and the claim that "the determination of our volition to local motion always coincides with a corporeal cause determining motion." However, the fact that this passage was preserved in a copy Leibniz made during his crucial stay in Paris in 1672–1676, before Leibniz's mature system emerged, suggests that Leibniz's contact with Descartes's thought *may* have played *some* role in the formulation of the doctrine of pre-established harmony.

72. Earlier versions of this paper were given to the Seventeenth-Century Seminar, Princeton Institute for Advanced Studies, June 1981; Committee on the Conceptual Foundations of Science, University of Chicago, November 1981; Hobart and William Smith College, April 1982; the Leibniz Society, meeting with the Western Division of the APA in spring 1982; and Princeton University, October 1982. I would like to thank members of the audiences there as well as Alan Gabbey, Robert Richardson, Howard Stein, and Peter Machamer for helpful discussion, comments, and suggestions. Since Machamer is publishing his extensive comments, I have made no attempt to incorporate them into the body of the paper.