

Descartes and Newton on Body

Diana Mertz Hsieh

diana@dianahsieh.com

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Introduction

Apart from his famous *cogito* argument for his own necessary existence, René Descartes is perhaps best known for his strong mind-body dualism. The central claim thereof, as found in *Meditations on First Philosophy* (1641) and *Principles of Philosophy* (1644), is that the world is divided into two mutually exclusive and jointly exhaustive substances, thinking mind and extended body.¹ On this metaphysics, the essence of body is extension alone, such that all other qualities of body are either reducible to extension (e.g. shape, motion), not necessary to body (e.g. hardness, heaviness), or actually in the mind (e.g. colors, tastes) (*Principles* 2.4, 2.11; CSM 1 224, 227; *Sixth Replies* 440; CSM 2 297). In addition, space is no different in reality than body since its essence is also extension (*Principles* 2.11; CSM 1 227). While few philosophers today accept this metaphysics of body, it was highly influential from the late 17th through the early 18th centuries as the necessary philosophic foundation of the reigning Cartesian physics.² Yet once overturned by Newtonian physics, that underlying metaphysics also lost favor: Cartesians were not major players in the later philosophic debates over space and time.³

The depth and breadth of Newton's rejection of Cartesian metaphysics is evident in *De Gravitatione*, an unpublished work of unknown date.⁴ In it, Newton vigorously attacks the "fictions" of the Cartesian theory of body on scientific, philosophic, and theological grounds (*De Gravitatione* 14). He argues that, by the basic principles of Cartesian physics, the motion of bodies could not be measured, nor even said to exist (*De Gravitatione* 19-21). He offers philosophic arguments that Descartes' exclusion of all but extension from the nature of body yields not bodies but only empty, inert space (*De Gravitatione* 33-5). A significant theme of Newton's criticisms is that the Cartesian theory of body is so far removed from any experience that its supposed bodies cannot rightly be regarded as such. In contrast, Newton's own account of body seeks to refine our ordinary understanding of body by identifying the minimal qualities of bodies as distinct from space.

In this paper, I will reconstruct Descartes' central arguments for his theory of body and space from comments found scattered throughout his writings. Then I will examine Newton's objections thereto, focusing upon the philosophic rather than the scientific or theological arguments. Finally, I will briefly consider whether Newton's own theory of body adequately fulfills his demand for bodies recognizable as such.

¹ All references to Descartes' writings come from the three volume set *The Philosophical Writings of Descartes*, translated by John Cottingham, Robert Stoothoff, Dugald Murdoch, and (for volume 3 only) Anthony Kenny.

² Andrew Janiak, "Introduction," in *Newton's Philosophical Writings*, ed. Andrew Janiak (New York: Cambridge University Press, 2004), xvii-xviii.

³ *Ibid.*, xviii-xix.

⁴ Regarding the dating of this unpublished work, see *Ibid.*, xviiiif14.. All references to this work are from Isaac Newton, "De Gravitatione," in *Newton's Philosophical Writings*, ed. Andrew Janiak (New York: Cambridge University Press, 2004 [1666?]).

The Cartesian Philosophy of Body and Space

Descartes' identification of extension as the essence (or nature) of body can only be understood within the framework of his general theory of essence, particularly its departures from the then-standard Scholastic view. In discussing those differences in his essay "Descartes' Physics," Daniel Garber explains that the scholastics drew a basic distinction between the essential and nonessential accidents of a substance.⁵ Essential accidents "constitute the essence or nature of [a] substance," as in man's essence of rational animality.⁶ Such essential accidents are not just necessary to a substance, but uniquely make it what it is. In contrast, nonessential accidents are not necessary to a substance, meaning that "they may be lost without changing the nature of the substance."⁷ Some nonessential accidents are products of the essential accidents, e.g. man's capacity for literacy. Others "bear no... relation to the essence," e.g. the length of the human small intestine.⁸ In this way, "the Aristotelian framework allows for there to be accidents which are, as it were, tacked onto substances... otherwise conceived of as complete."⁹

That Aristotelian approach to essence, Garber rightly observes, is "quite foreign to Descartes' way of thinking."¹⁰ For Descartes, "all the accidents in a corporeal substance must be understood through its essence, extension; there is nothing in body that is not comprehended through the essential property of extension."¹¹ So in the *Principles*, Descartes claims that "each substance has one principle property which constitutes its nature and essence, and to which all other properties are referred" (*Principles* 1.53; CSM 1 210-1). That understanding of essence is a basic starting point for Descartes. He is not concerned to argue for it, nor against the reigning Scholastic alternative, but simply to apply it to his two primary substances, i.e. body and mind. In the case of body, "extension in length, breadth, and depth constitutes the nature of corporeal substance" such that "everything else which can be attributed to body presupposes extension, and is merely a mode of an extended thing" (*Principles* 1.53; CSM 1 210-1).

This view of the relationship between the essence and the accidents of a substance imposes a heavy burden on Descartes' theory of body. To maintain that extension is the essence of body, Descartes cannot merely show that extension is necessary and fundamental to body, such that a body that loses its extension thereby ceases to be a body at all. He must show that all genuine qualities of body are mere aspects of extension, i.e. that they are reducible to extension. Any qualities not reducible to extension must be excluded body—not just from its essence, but from the substance entirely. Obviously, that is a tall order.

Descartes offers no single sustained argument for that understanding of body. However, he sketches his basic approach in the *Sixth Replies* of the *Meditations*, then fleshes out the details in various arguments scattered throughout his philosophic writings. In the *Sixth Replies*, Descartes seeks to alleviate doubts about the validity of his hard and fast distinction between body and mind via "a frank account" of his own method of ridding himself of "these same doubts" (*Sixth Replies* 439; CSM 2 296). He recounts that he did so by "attend[ing] to the ideas or notions of each particular [physical] thing which I found within myself" and "carefully distinguish[ing] them one from the other so that all my [rational] judgments should match them"

⁵ Daniel Garber, "Descartes' Physics," in *The Cambridge Companion to Descartes*, ed. John Cottingham (New York: Cambridge University Press, 1992), 293-4.

⁶ *Ibid.*, 293.

⁷ *Ibid.*, 294.

⁸ *Ibid.*

⁹ *Ibid.*

¹⁰ *Ibid.*

¹¹ *Ibid.*

(*Sixth Replies* 439; CSM 2 296). He then discovered that “nothing whatever belongs to the concept of body except the fact that it is something which has length, breadth, and depth and is capable of various shapes and motions” (*Sixth Replies* 439; CSM 2 296). So size, shape, and motion are the only qualities included in the concept of body. While shape and motion are not the essence of body, they are inalienable from and necessary to it: they are “merely modes [of body] which no power whatever can cause to exist apart from body” (*Sixth Replies* 439; CSM 2 296). Other qualities of bodies, namely “heaviness and hardness and the power to attract, or to purge, and all the other qualities which we experience in bodies,” are all reducible to extension via shape, motion, and position. They “consist solely in the motion of bodies, or its absence, and the configuration and situation of their parts” (*Sixth Replies* 440; CSM 2 296-7). In contrast, purely sensory qualities are properly associated with mind rather than body: “colors, smells, tastes, and so on, are... merely certain sensations which exist in my thought” (*Sixth Replies* 439; CSM 2 296). They lack any necessary connection to or resemblance of the genuine qualities of body; they are “as different from bodies as pain is different from the shape and motion of the weapon which produces it” (*Sixth Replies* 439; CSM 2 296). So for Descartes, the concept of body is nothing but the concept of a substance with size, shape, and motion—with extension as its essence. Let us now survey Descartes’ strongest arguments for this understanding of the nature and essence of body.

Sensory Qualities Are Not Qualities of Body

Early in the *First Meditation*, Descartes excludes the senses as trustworthy sources of knowledge on the grounds that they occasionally deceive us (*Meditations* 18, CSM 2 12). Yet his mistrust of the senses runs far deeper than ordinary concerns about bent sticks in water and other perceptual errors. Descartes dismisses attributions of sensations to external objects—such as describing a cup of tea hot or a blanket as red—as a naïve habit of childhood (*Principles* 1.71; CSM 1 219). His basic reasons for doing so also preclude any sensory qualities (e.g. colors, smells, tastes, sounds) from constituting any part of the nature of body.

In speaking of the causes of our sensations, Descartes observes that the senses are so thoroughly enmeshed in the body that any given sensation experienced by the mind may not be caused by any actual object external to the body. Instead, a sensation may be produced merely by “certain motions in the body,” namely those ordinarily serving as causal intermediaries between the stimulating object and sensation in the mind (*Principles* 4.197; CSM 1 284). So I may feel my skin burning due to its close proximity to a fire—or due to some horrible flesh-eating bacteria. Similarly, the motion that causes sensations of pain may be “present in the brain” only, as in the cases of phantom limb syndrome often cited by Descartes (*Principles* 4.196; CSM 1 283-4; *Meditations* 77, CSM 2 53). Since sensations may be produced within the human body just as well as by external objects, they are not necessarily connected with the external objects they seem to represent.

The gap between external objects and our sensations thereof runs far deeper than such occasional errors in identifying the causes of sensations for Descartes. He observes that sensations fail to *resemble* their material causes, whether understood as the intrinsic qualities of external objects or even just as the intervening bodily movements (*Principles* 4.197; CSM 1 284). So when “a sword strikes out body and cuts it... the ensuing pain is completely different from the local motion of the sword or the body that is cut” (*Principles* 4.197; CSM 1 284). The same applies to all other sensory qualities: the true nature of a scoop of chocolate ice cream is not revealed by its bittersweet taste, brown color, and cold feel, nor by any other sensory quality.

According to Descartes, “the properties in external objects to which we apply the terms light, color, smell, taste, sound, heat, and cold” seem to be nothing more than “various dispositions in the objects” which enable them to “set up of various kinds of motions in our nerves <which are required to produce all the various sensations in our soul>” (*Principles* 4.198; CSM 1 285). Those “dispositions in the objects” are the product of “the shapes, sizes, positions and movements of their parts”—yet sensory qualities conceal that true nature from us (*Principles* 4.198; CSM 1 285f1). Thus Descartes complains in the *Third Meditation* that sensations of heat and cold are felt with “so little clarity and distinctness” that we cannot tell “whether cold is merely the absence of heat or vice versa” (*Meditations* 43; CSM 2 30). We do not know the true cause (and meaning) of any given sensation from the sensation itself. External objects fundamentally differ only in their shapes, sizes, and motions, yet we perceive them in a fantastic variety of colors, sounds, tastes, and smells due to the mysterious operations of the mind.

These considerations about the cause and nature of sensory qualities show that the sensations of color, taste, heat, and the like that we ordinarily attribute to external objects do not reflect the true nature of such objects. More precisely, such sensory qualities are not qualities of body at all. They are qualities of the mind caused by the soul’s interaction with the body, usually (but not always) due to some stimulation of that body by external objects. Thus Descartes claims that our “sensations of tastes, smells, sounds, heat, cold, light, colors, and so on... do not represent anything located outside our thought” (*Principles* 1.71; CSM 1 219). Obviously, that precludes them from constituting any part of the nature of body.

Perceptible Intrinsic Qualities Are Not Necessary to Body

The exclusion of purely sensory qualities from body is hardly unusual for 17th century philosophy. The common distinction between primary and secondary qualities (i.e. between the intrinsic qualities of external objects and our sensory impressions thereof) treats colors, sounds, smells, tastes and the like as subjective products of the mind rather than as inherent in objects. Yet Descartes goes much further than required by that distinction, in that he argues against the inclusion of seeming primary qualities like weight and hardness in the nature of body.

Descartes’ most clear argument on this point found in the *Principles* 2.4, under the heading “the nature of body consists not in weight, hardness, color, or the like, but simply in extension” (*Principles* 2.4, CSM 1 224). Focusing on the case of hardness, Descartes observes that the perception of hardness in a body “tells us no more than that the parts of a hard body resist the motion of our hands when they come into contact with them” (*Principles* 2.4, CSM 1 224). Consequently, we would never experience hardness in any body “if, whenever our hands moved in a given direction, all the bodies in that area were to move away at the same speed as that of our approaching hands” (*Principles* 2.4, CSM 1 224). Since such bodies would not “thereby lose their bodily nature,” the nature of body “cannot consist in hardness” (*Principles* 2.4, CSM 1 224). According to Descartes, the very same analysis applies to “weight, color, and all other such qualities that are perceived by the senses as being in corporeal matter” (*Principles* 2.4, CSM 1 224).

Descartes sketches this same view in more general terms in a 1649 letter to Henry More. He argues that to define body in terms of perceived qualities would be to define it “by its relationship to our senses”—meaning that we would “explain only a certain property of it, rather than its whole nature” (AT V 268; CSMK 360). Descartes also argues that the nature of body “certainly does not depend on our senses, since it could exist even though there were no men” (AT V 268; CSMK 360). So while bodies and their qualities perceived by us, that form of knowledge cannot constitute any part of their nature.

At first glance, Descartes' basic concern in these two passages seems like little more than common sense realism. Since matter is metaphysically independent of any human mind, it exists according to its nature whether detected by our sense organs or not. Consequently, it cannot be properly defined in terms of perceptions of any kind, whether actual or potential. On closer inspection, however, that argument seems to miss its intended target.

According to the standard distinction between primary and secondary qualities, hardness and heaviness are paradigmatic examples of primary qualities. They are understood as intrinsic to bodies, i.e. as existing in the bodies whether perceived or not. That's why, unlike with secondary qualities such as taste and color, we observe the effects of the hardness and heaviness of bodies in their causal interactions with one another, as in the indent caused by dropping a brick into a wooden table. However, notice that Descartes does not speak of hardness as an intrinsic quality in this argument. He defines it purely in terms of the tactile perception of resistance, i.e. as if it were nothing more than a purely sensory or secondary quality. As such, Descartes has not shown that any intrinsic quality of hardness (or heaviness) must be excluded from the nature of body, merely the perception thereof. Even more strangely, the argument against hardness seems perfectly capable of excluding size, shape, and motion from the nature of body. After all, those qualities of bodies might be just as imperceptible as hardness under certain imaginable conditions. So precisely what is Descartes doing in these arguments?

In *Descartes: The Project of Pure Inquiry*, Bernard Williams interprets the argument about heaviness in *Principles* 2.4 as evidence of a more nuanced view of the distinction between primary and secondary qualities than held by Locke.¹² While Locke regarded hardness (or rather solidity) as a primary quality, Descartes understands it to be a secondary quality because it depends on contingent facts about the interaction of bodies relative to our senses.¹³ Williams observes that Descartes adopts “an *a priori* concept of reason” as a substitute for the empirical notion of hardness or solidity—namely the idea of “the impossibility of two bodies being in the same place at the same time.”¹⁴

Williams' analysis is basically right, but it does not go far enough. After all, hardness is not the only seemingly primary quality that Descartes would re-classify as a secondary quality. Descartes explicitly states that weight is on par with hardness in the argument in *Principles* 2.4. Presumably since that feeling of downward pressure might never be felt, weight must also be excluded from the nature of body. Even more broadly, Descartes declares in *Principles* 4.191 that all of our ordinary terms for intrinsic qualities of body refer to nothing more than our perceptions. He writes, “we call these qualities hardness, heaviness, heat, humidity, and so on, but all that is meant by these terms is that the external bodies possess what is required to bring it about that our nerves excite in the soul the sensations of hardness, heaviness, heat etc.” (*Principles* 4.191; CSM 1 282). Descartes thus downgrades all the qualities regarded as primary by empiricists to mere perceptions. So the argument in 2.4 is not directed against hardness understood as an intrinsic quality of bodies. Rather, it is an argument for excluding any and all *empirical* concepts of bodily qualities from the nature of body. So the initially troubling analogy of hardness to size, shape, and motion suggested above is perfectly apt but less troubling: only the empirical concepts of those qualities must be excluded from the nature of body, not the purely rational concepts thereof. If the distinction between primary and secondary qualities

¹² Bernard Williams, *Descartes: The Project of Pure Inquiry* (New York: Routledge, 1978), 222-4.

¹³ *Ibid.*, 223.

¹⁴ *Ibid.*, 224.

retains any meaning on Descartes' view, the only primary qualities of body are those grasped by reason alone.

This interpretation of Descartes' arguments about heaviness and other supposedly intrinsic qualities is supported by his thought experiment about the melting wax in the *Second Meditation*. Descartes' basic purpose in this famous thought experiment is to firmly cement the prior certainty of consciousness implied by the *cogito* by showing that reason, not the senses or imagination, is the sole source of any distinct knowledge of body. In so doing, he excludes all perceived qualities from the nature of the wax, albeit by somewhat different means than in the argument about heaviness. His mode of argument about such qualities sheds significant light on his own method for determining the essence of body.

Descartes begins his experiment by examining the piece of wax before him, listing its seemingly distinct sensible qualities: the taste of honey, scent of flowers, hardness, coldness, solidity, size, and so on (*Meditations* 30; CSM 2 20). Yet he notices that all such perceptible qualities are superseded by others when the wax is heated by the fire, e.g. "the smell goes away, the color changes, the shape is lost" (*Meditations* 30; CSM 2 20). In light of this radical change in all these qualities in the wax, Descartes concludes that his distinct understanding of the wax was not gleaned from the senses. He asks, "So what was it that I understood with such distinctness?" and answers, "Evidently none of the features which I arrived at by means of the senses; for whatever came under taste, smell, sight, touch, or hearing has now altered—yet the wax remains" (*Meditations* 30; CSM 2 20). Descartes claims to understand the wax as "merely something extended, flexible, and changeable" (*Meditations* 31; CSM 2 20). That understanding is not due to the operations of imagination on sensory impressions either, Descartes reasons. It is not a matter of envisioning the wax "changing from a round shape to a square shape or from a square shape to a triangular shape" because he can "grasp that the wax is capable of countless changes of this kind" even though "unable to run through this immeasurable number of changes in [his] imagination" (*Meditations* 31; CSM 2 20-1). The wax must be "perceived by the mind alone" as a matter of "purely mental scrutiny"—yet that wax is the same as the wax perceived and imagined (*Meditations* 31; CSM 2 21).

Bernard Williams persuasively argues that Descartes' purpose in this thought experiment is not to demonstrate that the perceived qualities of the wax cannot constitute its essence due to their myriad changes over time.¹⁵ That would be strange, most obviously because the qualities that Descartes ultimately identifies as part of the nature of the wax (e.g. shape, flexibility) change with the application of heat just as much as color and hardness.¹⁶ Instead, Williams argues, Descartes' argument must be understood as primarily epistemological, i.e. as aiming to show that his distinct idea of the wax (and any bodily substance) cannot be derived from perception, whether with imagination or not.¹⁷ Perception does not reveal any stable nature to the wax, while imagination yields only a series of particulars, not a truly abstract understanding. So to grasp the nature of any body, we must not seek answers in perception or imagination but rather in the clear and distinct ideas of unaided reason. When we do that for body itself, we will discover that its essence is extension alone.

As we have seen, Descartes holds that the senses have little to offer us by way of knowledge of body. That is consistent with his general view of the function of the senses. According to Descartes, the senses do not seek to "show us what external bodies are like in

¹⁵ Ibid., 199-210.

¹⁶ Ibid., 204-5.

¹⁷ Ibid., 208.

themselves,” but rather to alert us to “the benefit or harm that external bodies may do to this combination [of human body and mind]” (*Principles* 2.3, CSM 1 224). To understand the world, we must set aside our “preconceived opinions acquired from the senses” and “make use of the intellect alone, carefully attending to the ideas implanted in it by nature” (*Principles* 2.3, CSM 1 224). However, before employing that rationalist method to discover the true nature of body, we should examine Descartes’ argument against the inclusion of any intrinsic quality but size, shape, and motion in the nature of body.

Most Intrinsic Qualities Are Not Necessary to Body

Descartes’ fundamental case for identifying body with extension is grounded in his rationalist method: the nature of body can only be grasped by reason alone without reference to sensory data. To round out that case, he offers a more standard metaphysical argument in *Principles* 2.11 to support his claim that “the nature of a body is exactly the same as that constituting the nature of a space,” namely extension (*Principles* 2.11, CSM 1 227). Descartes writes:

Suppose we attend to the idea we have of some body, for example a stone, and leave out everything we know to be non-essential about the nature of body: we will first of all exclude hardness, since if the stone is melted or pulverized it will lose its hardness without thereby ceasing to be a body; next we will exclude color, since we have often seen stones so transparent as to lack color; next we will exclude heaviness, since although fire is still light, it is still thought of as being corporeal; and finally we will exclude cold and heat and all other such qualities, either because they are not thought of as being in the stone, or because if they change, the stone is no on that account reckoned to have lost its bodily nature. After all this, we will see that nothing remains in the idea of the stone except that it is something extended in length, breadth, and depth (*Principles* 2.11, CSM 1 227).

The basic thrust of this argument is simple enough: To form part of the nature or essence of a given substance, a quality must be necessary to that substance such that without the quality the substance would cease to be a substance of that kind. No quality optional to a given substance can form part of its nature—yet that’s precisely the status of the various qualities of bodies like heat, hardness, and color. In contrast, extension is truly necessary to body.

While simple in outline, this argument is confusing in its details. As we’ve seen, Descartes is determined to define terms like “color” and “heaviness” in terms of perceptions. Yet in this case, he seems to accept that color, heaviness, and maybe even heat/cold are intrinsic qualities of body. Descartes is probably best understood as conceding an empiricist premise for the sake of argument. So his point is that even if these various qualities are thought of as intrinsic to body, they still must be excluded from the nature of body on the grounds that they are not necessary for bodies to be bodies. Notably, Descartes cannot prove that merely by showing that these various qualities of body change in their particular values over time.¹⁸ That argument would also exclude size, shape, and motion from the nature of body, yet Descartes certainly does not wish to do that. Instead, he must show that genuine bodies may lack these qualities entirely—as in the case of the transparent stone and the light fire. The problem for Descartes is that this line of argument cannot exclude heat/cold from the nature of body: a body always seems to have some temperature or other, i.e. the temperature merely changes. That is likely Descartes’ reason for mentioning the possibility that heat/cold are not in bodies at all, even though that muddles the argument by withdrawing the premise originally granted.

¹⁸ Ibid., 203-4.

The Nature of Body Is Extension, With Shape and Motion as Modes Thereof

In the *Meditations*, Descartes begins his purely rational inquiry into the nature of body in the course of his ontological argument for the existence of God in the *Third Meditation* (*Meditations* 43-5; CSM 2 29-31). In arguing that his various ideas of body—unlike his idea of God—might originate solely from within him, he writes:

For if I scrutinize [my ideas of corporeal things] thoroughly and examine them one by one in the way in which I examined the idea of the wax yesterday, I notice that the things which I perceive clearly and distinctly in them are very few in number. The list comprises size, or extension in length, breadth, and depth; shape, which is a function of the boundaries of this extension; and motion, or change in position; to these may be added substance, duration, and number. But as for all the rest, including light and colors, sounds, smells, tastes, heat and cold and the other tactile qualities, I think of these only in a very confused and obscure way, to the extent that I do not even know whether they are true or false, that is, whether the ideas of have of them are ideas of real things or non-things (*Meditations* 43; CSM 2 30).

So after excluding his muddled sensory impressions from his understanding of body, Descartes is left with only six clear and distinct ideas of body: substance, duration, number, size, shape, and motion.¹⁹ To show that his own mind might be the source of these distinct ideas of body—and so to leave open the possibility that no bodies exist at all—Descartes divides them into two distinct categories. The distinct ideas of substance, duration, and number are not unique to body, but are common to mind as well (*Meditations* 44; CSM 2 30). The qualities of size, shape, and motion (as well as position) are unique to body, although he supposes that he might have somehow “borrowed” them from his own mind nonetheless (*Meditations* 44-5; CSM 2 30-1). Notably, Descartes attempts no argument for these six clear and distinct ideas of body. They are simply a matter of introspection that anyone employing proper Cartesian methodology ought to be able to confirm with his own thinking.

Descartes more directly and extensively discusses these two categories of distinct ideas—substance, duration, and number versus size, shape and motion—in a 1643 letter to Princess Elizabeth. He observes that all our myriad ideas are based on certain basic ideas: “there are in us certain primitive notions which are as it were the patterns on the basis of which we form all our other conceptions” (AT III 665; CSMY 218). The “most general” of these ideas are “those of being, number, duration, etc.”; they “apply to everything we can conceive” (AT III 665; CSMY 218). In contrast, others apply only to body or only to mind (AT III 665; CSMY 218). Of the ideas unique to body, Descartes emphasizes the primacy of extension in the list itself, writing “we have only the notion of extension, which entails the notions of shape and motion” (AT III 665; CSMY 218). Notably, a similar relationship of extension to shape and motion is implicit in the passage from the *Third Meditation* quoted above, in that Descartes describes size, shape, and motion in terms of extension. Size is “extension in length, breadth, and depth,” shape is “a function of the boundaries of this extension,” and motion is “change in position,” i.e. change in distance from (or extension with respect to) other bodies (*Meditations* 43; CSM 2 30).

Descartes’ most explicit (albeit still brief) statement of the primacy of extension over shape and motion is found in the *Principles* 1.53. To justify his claim that “extension in length, breadth, and depth constitutes the nature of corporeal substance,” Descartes notes that

¹⁹ Since motion is change of position, the idea of body must be a clear and distinct idea of body too. Descartes explicitly includes it as on par with size, shape, and motion in the ensuing discussion (*Meditations* 45; CSM 31). Yet most of the time he simply speaks of size, shape, and motion, as I will do.

“everything else which can be attributed to body presupposes extension,” such that it is “merely a mode of an extended thing” (*Principles* 1.53; CSM 1 210). So “shape is unintelligible except in an extended thing” and “motion is unintelligible except in an extended space” whereas “it is possible to understand extension without shape or movement” (*Principles* 1.53; CSM 1 210-1). In general, Descartes holds that “a complete understanding of body” requires only thinking of a “something having extension, shape, and motion” (*First Replies* 121; CSM 1 86).

As we shall see shortly, Newton argues that extension alone cannot account for all the experienced qualities of body. Yet an even easier criticism of Descartes’ view is possible, namely the standard criticism of the late 17th century that extension entails shape but not motion.²⁰ As Pierre Bayle put the point in his *Dictionary*: “Motion is not essential to extension. It is not contained in the idea of it, and many bodies are at rest from time to time. Motion is thus an *accident*.”²¹ More precisely, while motion may presuppose extension, extension does not entail motion. So a body may be extended yet at rest. However, by the argument against non-necessary intrinsic qualities discussed above, that would require motion to be excluded from the nature of body.

Space Is No Different in Reality Than Body

Once Descartes identifies the essence of body as extension, he need only observe that the essence of space is also extension to deny any “real distinction between space... and the corporeal substance contained in it” (*Principles* 2.10, CSM 1 227). So the only difference between space and body is conceptual, since “in reality the extension in length, breadth, and depth which constitutes space is exactly the same as that which constitutes a body” (*Principles* 2.10, CSM 1 227). Descartes explains the conceptual distinction as follows. We think of the extension of bodies as “something particular” and thus “as changing whenever there is a new body” (*Principles* 2.10, CSM 1 227). In contrast, we think of the extension of space as “a generic unity”—meaning that “when a new body comes to occupy the space, the extension of the space is reckoned not to change but to remain one and the same, so long as it retains the same size and shape and keeps the same position relative to external bodies which we use to determine the space in question” (*Principles* 2.10, CSM 1 227).

Descartes draws a number of significant conclusions from his identification of space with body. Most important for our purposes is his claim that the equivalence precludes the possibility of genuinely empty space. Given that “the nature of matter ... consist[s] mere in its having extension in length, breadth, and depth,” Descartes argues that empty space is impossible because “we cannot conceive of such a space without conceiving it in these three dimensions and consequently [as] matter” (AT V 52; CSMK 320). Elsewhere, he claims that since “real properties” such as size, shape, and impenetrability “can exist only in a real body, ... there can be no completely empty space [and] every extended being is a genuine body” (AT V 271; CSMK 362). In fact, according to Descartes, the only sensible meaning of “empty space,” is space that “contains nothing perceivable by the senses” (*Principles* 2.17, CSM 1 230).

Newton’s Criticisms of Descartes

The philosophic criticisms of the Cartesian theory of body and space developed by Newton in *De Gravitatione* are not detailed analyses of arguments. They are broad criticisms of two aspects of the theory. First, Newton argues that the exclusion of sensory or perceived

²⁰ John Cottingham, *The Rationalists, A History of Western Philosophy* (New York: Oxford University Press, 1988), 136.

²¹ Quoted in *Ibid.*

qualities from body is not grounds for excluding any intrinsic powers of body. Second, Newton argues that the exclusion of those intrinsic powers from body would reduce body to nothing but empty space. Let us examine each of these criticisms in turn.

Newton introduces the first criticism by accepting the Cartesian method of elimination: “let us abstract from body (as [Descartes] demands) gravity, hardness, and all sensible qualities, so that nothing remains except what pertains to its essence” (*De Gravitatione* 33-4). The resulting idea of body will not consist of “extension alone” as Descartes claims (*De Gravitatione* 34). Extension alone cannot explain the causal powers of body, particularly not the “faculty or power by which they [the qualities] stimulate the perceptions of thinking things” (*De Gravitatione* 34). According to Newton, the wholly opposite nature of the Cartesian substances of body and mind means that any “connection or relation” between them would require some “divine power” (*De Gravitatione* 34). In other words, God must somehow endow body with the capacity to move and be moved by mind—yet that divine alteration of a substance would affect its nature, not merely its accidents (*De Gravitatione* 34). Then the capacity of bodies to arouse perceptions in minds would have to be counted as part of the nature of body. Newton thus concludes that body cannot be reduced to extension alone, not even within the framework of Cartesian philosophy, since extension cannot explain the power of bodies to arouse perceptions in minds.

While this argument has some merit, its appeal to divine power seems introduce unnecessary complications. All that need be said is that the extension of bodies cannot plausibly explain the power of bodies to arouse sensations in unextended minds. Even the bodily quality of impenetrability—which Descartes regards as inherent in extension and which might explain some of the powers of bodies to effect changes in other bodies—would have no causal impact on the mind. So contrary to Descartes’ theory, the nature of body must include something more than extension and its modes. That argument shows that Descartes’ inability to explain the causal interactions between mind and body creates just as much a problem for his philosophy of body as for his philosophy of mind.

Newton’s second criticism of the Cartesian theory of body concerns the power of bodies to causally influence other bodies. To explain the actions of bodies, the nature of body must include “that other faculty by which bodies are enabled to transfer mutual actions from one another” (*De Gravitatione* 34). These powers are not mere sensory impressions, as we’ve seen Descartes claim. They are clearly intrinsic powers of the body, operative whether any minds exist or not. So to remove these powers from body, as Descartes does, would be to “reduce body to empty space” (*De Gravitatione* 34). It would make bodies causally inert. For example, Newton argues that “if we set aside altogether every force of resistance to the passage of bodies [in a medium], we must also set aside the corporeal nature [of the medium] utterly and completely” (*De Gravitatione* 34). So if the “subtle matter” of Cartesian physics were “deprived of all forces of resistance to the motion of globules,” it would no longer be subtle matter but instead “a scattered vacuum” (*De Gravitatione* 34). In short, to speak of body as nothing but extension is to rob body of all the qualities that distinguish it from empty space.

This argument is compelling on its face. Since extension alone has no causal powers, merely extended substances would be no different from empty, inert space. So by identifying body with extension, Descartes robs bodies of their causal powers. However, Descartes does have something of a reply to this objection at his disposal. Descartes regards impenetrability as an intrinsic quality of bodies inherent in extension. (As such, it would belong to the nature of body with size, shape, and motion.) So in a 1649 letter to More, Descartes writes of the

impossibility of thinking of “one part of an extended thing penetrating another equal part” unless also thinking “that half of the total extension is taken away or annihilated” (AT V 342; CSMK 372). Since “what is annihilated does not penetrate anything else... impenetrability belongs to the essence of extension” (AT V 342; CSMK 372). Unfortunately for Descartes, this argument begs the question by presupposing that any extended body is a perfectly filled plenum. That is not necessary to the idea of an extended body, yet it’s what makes the bodies in the thought experiment impenetrable simply for being extended.

In contrast with Descartes, Newton’s own account of body seeks to identify the minimal conditions required for bodies to be empirically recognized as such. Newton asks his readers to consider some particular area of empty space that “happens by divine power to be impervious to bodies” such that it “would resist the motions of bodies and perhaps reflect them” (*De Gravitatione* 28). Further, consider that the area of impenetrable space could be moved, i.e. “transferred here and there according to certain laws” without changing its “quantity and shape” (*De Gravitatione* 28). These mobile, impenetrable spaces would be perceivable, as well as influenced by human actions: they would be able to “operate on our minds and in turn be operated upon” (*De Gravitatione* 28). Such “beings,” Newton claims, would “either be bodies, or very similar to bodies” (*De Gravitatione* 28). In light of this thought experiment, Newton defines bodies as “determined qualities of extension which omnipresent God endows with certain conditions,” namely (1) mobility, (2) impenetrability, (3) perceptibility (*De Gravitatione* 28-9).

While Newton’s thought experiment is ingenious, the resulting theory of body seems just as incapable of accounting for causation from one body to another or from body to mind as Descartes’ theory of body. Regarding causation between bodies, Newton’s supposition that all or most of the causal powers of bodies would be explained by extension, mobility, and impenetrability is not merely remarkably Cartesian. It is also wholly unjustified by any empirical reasoning: Newton has not actually reduced the myriad causal powers of bodies to those properties. Moreover, Newton never specifies how those qualities—or any others—might make possible perception. He seems to be in no better position to explain causation between body and mind than Descartes. The difficulty is simply not so apparent since Newton offers no detailed account of mine.

So despite his empiricist concerns, Newton’s theory of body is not equipped to explain our everyday observations of bodies any better than Descartes’ theory of body. However, in evaluating Newton’s theory of body, we must remember that he never published *De Gravitatione*—perhaps due to worries about the inadequacy of his arguments. Descartes cannot be offered any such reprieve.