How Newton Solved the Mind-Body Problem

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1. Introduction

The recent resurgence of interest in Isaac Newton’s metaphysics has revived a set of scholarly concerns that were earlier emphasized by Burtt (1952), Koyré (1957), and Baker (1930), especially the theological underpinnings of absolute space and time. However, another central problem of seventeenth-century metaphysics, the relation between mind and body, never figured prominently for these path-breaking scholars, despite Newton’s famous likening of bodies in absolute space to ideas in God’s “sensorium.” Fortunately, the 1962 publication of Newton’s lengthy, highly philosophical manuscript De Gravitatione et Aequipondio Fluidorum (henceforth De Grav) has brought greater attention to this dimension of his thought. Ostensibly a treatise on hydrostatics, De Grav quickly turns to criticism of Descartes’ relationist conceptions of place and motion, followed by a detailed articulation and defense of Newton’s own absolutist theory of space and time. And this leads, in turn, to an elaborate—certainly, Newton’s most elaborate—discussion of mind-body interaction. This philosophical digression on the mind-body problem is required, according to Newton, “since it is on the distinction between thinking and extended substances, or rather between thought and extension, that the Cartesian philosophy is principally founded” (De Grav 21). Drawing on De Grav, scholars such as Tamny (1979), Iliffe (1995), and Dempsey (2006) have recently contributed to a much richer understanding of Newton’s concept of mind and its place in his natural philosophy, physiology, and theology.

Nevertheless, there are subtle aspects of the De Grav discussion of the mind-body relationship that have not been fully analyzed or understood. These details are important for a number of reasons. First, they shed considerable light on the radically voluntarist, borderline occasionalist theory of matter that Newton propounded in De Grav (and
that may have tempted John Locke). Second, they help to dispel some surprisingly common misconceptions about the ontology of Newtonian minds and their relation to space and time. Third, the *De Grav* account of mind-body interaction is distinctly echoed in the notoriously obscure *sensorium* model of absolute space in the later *Opticks*. Finally, close examination of *De Grav* reveals a significant, but rarely noted, debt to René Descartes. Although the “Cartesian philosophy” is Newton’s principal target in *De Grav*, his route to an alternative philosophy is guided by a Cartesian theory of causation.

2. Newtonian Bodies

To understand properly Newton’s solution to the problem of interaction, we need to begin with his views on the natures of bodies and minds themselves. The upshot of the physical arguments that open *De Grav* is that “it is necessary that the definition of places, and hence of local motion, be referred to some motionless thing such as extension alone or space alone insofar as it can be seen truly distinct from bodies” (*De Grav* 20–21). After explaining the properties of this absolute space—Euclidean, infinite, immobile, uncreated, eternal, and independent of all bodies—Newton presents a “more uncertain” account of body. The account is more uncertain because, whereas space is uncreated, body “does not exist by necessity but by divine will” (*De Grav* 27). Newton proposes that God creates bodies by imposing three conditions on certain regions of space or “determinate quantities of extension” (DQE):

1. mobility within absolute space
2. mutual impenetrability
3. the power to produce sensations in minds and to be moved by minds

In addition, God ensures that the motions and collisions of the DQEs are “in accord with certain laws” (*De Grav* 28–29). With this conception of body, Newton believes he is able to uphold the distinction between extension and matter, contrary to Descartes, while dispensing with substantial forms and prime matter (and corporeal substance itself), contrary to Aristotle. Moreover, since it grounds matter directly on God’s continuous volition, this conception avoids the “sure path to atheism” Newton detects in Descartes’ account, which allegedly permits “a conception of body without any relation to God” (*De Grav* 31). So, although Newton presents his theory of body as hypothetical—“I have no clear and distinct perception of the matter” (*De Grav* 27)—he clearly considers it the best hypothesis on offer. Since a favored DQE would be “similar in every way” to body, “we can hardly say that it is not body” (*De Grav* 27).
The first part of condition (3) might appear superfluous. For, as Newton himself observes, if the DQEs are impenetrable, they will be solid to touch, reflect light, perturb the air when struck, and so on. Since these are the means by which the senses perceive familiar bodies, why the need for God to affix also the special power to produce sensations? The answer seems to be that impenetrability alone is inadequate to distinguish bodies from the unfavored portions of absolute space. And without this distinction, the condition of mobility (1) cannot get hold since Newton insists the parts of space are absolutely immobile in themselves. Impenetrability cannot serve to distinguish a given DQE from the empty space that surrounds it because, as Bennett and Remnant have noted, all the various portions of absolute space are already mutually impenetrable regardless of God’s will. Two spaces cannot interpenetrate because their location is their identity: “if any two could change their locations they would change their individuality at the same time and each would be converted numerically into the other” (De Grav 25). So, nothing is changed by attributing mere impenetrability to regions of space with the shapes of familiar bodies—“a vacuous exercise of God’s power,” as Bennett and Remnant put it.

It is true, of course, that spaces as such are not impenetrable to bodies, so God could create a “virtual” body by willing a part of space to be newly impenetrable by already-existing light and air particles. Indeed, Newton himself describes how God might “cause some space projecting above the earth, like a mountain or any other body, to be impervious to bodies and thus stop or deflect light” (De Grav 27–28). But this will not suffice as an account of the nature and creation of body since it presupposes that certain bodies are already distinguished from pure space by some other means than impenetrability. And Newton clearly wants to explain God’s creation of matter wholesale and ex nihilo, not merely his power to conjure tricks of the light. Thus, immediately after introducing his impenetrable “space mountain,” Newton proceeds to generalize the account to matter as a whole: “if all of this world were constituted out of these beings it would hardly seem to be inhabited differently” (De Grav 28). So, the problem remains: mutual impenetrability adds nothing to a universe of absolute and empty space.

Condition (3) solves this problem by ensuring that the favored regions of space stand out because God superadds to them something lacking from the unfavored regions: the power to produce sensations. So, contrary to Bennett and Remnant’s own verdict that Newton “does not have the resources” to account for bodies, it turns out that he accounts for them through their phenomenal powers. Even if we reject all other accidents of bodies, Newton says, there would remain not mere extension “but also the capacities by which they can stimulate perceptions in the mind” (De
But note that with (3) distinguishing bodies from mere space, (1) and (2) do no independent work of their own. Bodies are movable simply because the quantities of power are “transferred here and there according to certain laws” by God (De Grav 28). And they are mutually impenetrable in the sense that we do not perceive distinct bodies occupy the same time and place but rather are “reflected in accordance with certain laws” (ibid.).

The paramount role of (3) in the definition of bodies is made more explicit when Newton later explains the inadequacy of the Cartesian notion of body. If we follow Descartes in abstracting from body such attributes as gravity and hardness, there would still remain in addition to mere extension “that power or faculty by which they stimulate the perceptions of thinking things” (De Grav 34). But if we abstract away even this power, what is left is mere space alone: “the above capacity can be rejected while preserving extension but not while preserving their corporeal nature” (ibid.). So, the capacity to produce sensations in minds is sufficient and necessary for a quantity of space to possess the nature of body. This explains why Newton privileges condition (3) when he introduces his theory of creation: “the description of their [bodies’] origin is founded on this” (De Grav 29).

As quantities of power superadded to varying regions of space, Newtonian bodies do not seem to qualify as self-standing substances. Indeed, Newton asserts that, since on this model “God does not sustain his creatures any less than they sustain their accidents,” therefore the idea of creatures “no less involves the concept of God than the idea of accident involves the concept of created substance” (De Grav 32). But Newton resists indentifying bodies too closely with God. They are not simply his volitions since there is a clear logical distinction “between the formal reason of bodies and the act of the divine will”: God’s act is the cause; bodies are “the effect which that act produces in space” (De Grav 31). Moreover, God does not produce our sensations directly but through the intermediary of space: “it is certain that God can stimulate our perceptions by means of his own will, and therefore apply such power to the effects of his will” (De Grav 28).

Nevertheless, Newton’s theory of matter brings him very close to the occasionalist view that God himself is the efficient cause of our sensations. For on his theory, the continuous creation of matter amounts simply to the distribution within space of God’s power to produce sensations. And it is not in virtue of any permanent or intrinsic feature of space that a given DQE can affect our senses, since space in itself is “not capable . . . of inducing change of thought in mind” (De Grav 33). Rather, it is only because God wills that we should perceive qualities
at this site that the DQE is perceived as a body. As such, DQEs qualify at best as “occasional causes” in the sense of some seventeenth-century philosophers. As Steven Nadler explains, for Cartesians like Louis de la Forge, although there will be a “nomological correlation” between bodies and the familiar sensations we register, “the relationship is not grounded in some ontically real power in the bodies.” Rather, Nadler observes, the historical tendency with respect to occasional causation “is to locate the ground in God’s will.” Newton falls in line with this tradition. For him, various quantities of extension are the mere “spatial occasions” for God to bring about our perceptions in the successive and law-like ways we associate with moving bodies: “I posit that any form may be transferred through space; and everywhere denote the same body” (De Grav 29).

3. Newtonian Minds

Newton departs less decisively from Descartes when it comes to the nature of mind. He does explicitly reject Descartes’ “nullibism” (Henry More’s label for the doctrine that minds are strictly speaking nowhere): “God is everywhere, created minds are somewhere and body is in the space that it occupies” (De Grav 23). This is one of the reasons he finds Descartes’ philosophy “unintelligible”: to say the mind exists nowhere “seems the same as if we were to say it does not exist” (De Grav 31). However, from the fact that divine and finite minds are necessarily in space, it does not follow that they are extended in the way bodies are, much less that Newton is a substance “monist,” as more than one commentator has recently suggested. Newton stresses that God’s being everywhere does not mean he is “like a body, extended and made of divisible parts” (De Grav 26), for, first, not even space itself is “actually divisible” into parts (De Grav 25). As explained above, given the parts of Newtonian space are individuated by their mutual positions, it is impossible to move or separate them. In More’s terminology, they are “intellectually divisible” but not “discerpible.”

Furthermore, minds themselves are not even conceptually or intellectually divisible into parts. Newton insists that each thing has “a manner proper to itself of being present in space.” To explain the very different manners in which bodies and minds are spatial, he relies on an analogy with time:

Thus the relation of duration to space is very different from that of body to space. For we do not ascribe different durations to the different parts of space, but say they all endure simultaneously. The moment of duration is the same at Rome and at London, on the earth and on the stars, and throughout the heavens. And just as we conceive any moment of duration to be diffused through all space, according to its
kind, without any conception of its parts, so it is no more contradictory
that mind can also in its own way be diffused (diffundi) throughout
space without any conception of parts.” (De Grav 25)

Just as the same moment of duration can be at Rome and London with-
out having parts that are east and west of Paris, the same mind can be
extended through space (or a body) without being partly here and partly
there. And just as a certain moment of duration can really exist at vari-
ous places without implying that the moment has a shape or a size,23
likewise the same mind can really and substantially exist in different
bodily organs, and God can exist at all points in space, without having a
geometrical structure. The absolutely part-less extension and duration
of minds, in contrast with space, time, and bodies, are later reasserted
very firmly in the published General Scholium to the Principia:

“There are parts that are successive in duration and coexistent in
space but neither of these exist in the person of man or his thinking
principle, and much less in the thinking substance of God. Every man,
in so far as he is a thing that has senses, is one and the same man
throughout his lifetime in each and every organ of his senses.”24

He goes on to declare that God “totally lacks any body and corporeal
shape.”25 So, although Newton requires mind, like everything else, to be
in space—“whatever is neither anywhere nor everywhere does not exist”
(De Grav 25)—he retains a fundamental distinction between minds and
bodies: only the latter are divisible into parts. This view, of course, he
shares with Descartes: “there is a great difference between the mind
and the body inasmuch as body is by its very nature divisible while the
mind is utterly indivisible.”26 To summarize, for Newton there are three
ways of being spatially extended:

(i) having parts that are separable (really distinct or
discernible)

(ii) having parts that are distinct but not separable
(intellectually distinct)

(iii) having one or more locations but no parts (extended but
indivisible)27

Bodies are extended in the sense of (i); space and time in the sense of
(ii); minds in the sense of (iii).28

So, Newton embraces Descartes’ dualism that, with respect to the key
issue of divisibility, “the natures of mind and body are not only different
but in some way opposite.”29 Yet some commentators have found a dif-
f erent reason for holding that Newton is not a substance dualist in the
Cartesian sense: he does not consider bodies or minds to be substances at
all. Howard Stein, for example, has suggested that, in De Grav, Newton
“sets aside the distinction of kinds of substance: mind-body dualism or monism, in favor of the program: to seek to understand mental attributes and their relation to corporeal ones.” Stein stresses a passage in which Newton concludes “it would be rash to say what the substantial basis of mind might be” (De Grav 33). The focus of this passage, however, is the peculiar scholastic “prejudice” that takes substances to be substrata, which Newton dismisses as “unintelligible” (De Grav 32). His point is not that minds are mere attributes but rather that the scholastic prejudice must be “laid aside and substantial reality should be ascribed to these kinds of attributes which are real and intelligible beings in themselves” (ibid.). Minds qualify as substances even if they lack substrata.

In place of the unintelligible scholastic notion, Newton offers the following criteria for substance: (a) “absolute in itself”; (b) “can act upon things” (De Grav 21). Newton says that in bodies “extension takes the place of the substantial subject in which the form of the body is conserved” (De Grav 29). So, bodies are not absolute in themselves but inhere in space. In contrast, although all creatures ultimately depend on God, minds depend on no other things for ontological grounding. So, minds but not bodies satisfy (a). The same is true of condition (b). Bodies can act on minds but only because God constantly lends this power to quantities of extension. Indeed, as I argued above, bodies are essentially constituted by this borrowed power. For this reason Newton says bodies have “only a derivative and incomplete reality” (De Grav 32). There is no corresponding suggestion that our own power must be continuously superadded by God. On the contrary, Newton says that God creates the world “just as we move our bodies by an act of will alone” (De Grav 30). So, if we stick to Newton’s own terms, minds are substances but bodies are, at best, shifting modes of space.

4. Mind-Body Interaction

I now consider Newton’s attempt to explain mind-body interaction. His fascination with the problem, and the influence of Descartes, is already evident from notes recorded as a student around 1664. Speculating on the origin of our ideas, Newton invokes as a fundamental constraint the familiar Cartesian principle that causes must contain at least as much reality or perfection as their effects: “an idea, by how much the more perfect, so much the more perfect must its cause be, whether it be the object or thing that eminently contains it, or another idea.” The year before, he had transcribed the more general version of Descartes’ causal principle from Daniel Stahl’s (1664) Axiomata Philosophica: “Everything which is in the effect pre-exists in the cause. One thing is found in another either eminently or formally.” The youthful Newton was not merely aping the famous “Cartes.” For, as I will now explain,
the causal principle figures centrally in the *De Grav* attack on Cartesian interaction and in Newton’s own solution to the mind-body problem.

Hoping to forestall objections to his unorthodox theory of matter, Newton acknowledges that it raises acutely the problem of God’s operation in the world: “If there is a difficulty with this conception it does not concern the form that God imparts to space but the manner by which he imparts it” (*De Grav* 29). In response, Newton first pleads that we face the same difficulty understanding our own voluntary movement, but we do not for this reason deny ourselves this power. Echoing Descartes’ confession to Henry More that he can only conceive how God acts on matter through the idea “which shows me the way in which I am conscious I can move my body,” Newton says that from our “innermost consciousness,” we can understand that God creates matter “just as we move our bodies” (*De Grav* 30). But at this point, Newton worries the analogy goes too far: “we ourselves are created things and so a share of this attribute [creation] could not have been equally granted to us” (ibid.). In particular, we should not be able to create minds. He attempts to turn this objection to his advantage, insisting that his account explains both why we cannot create minds and why we can move bodies. Although we are not “more noble” than other finite minds, we are more noble than bodies and therefore contain their perfections eminently:

For if for this reason the faculty of creating minds is not delineated in any faculty of created mind, nevertheless created mind (since it is in the image of God) is of a far more noble nature than body [*naturae longe nobilioris quam corpus*] so that it may perhaps eminently contain [body] within itself [*eminenter in se contineat*]. (ibid.)

This passage strongly recalls, in content and phrasing, Descartes’ Sixth Meditation assertion that the cause of our ideas of body is either body itself “or else it is God or some other creature more noble than a body [creatura corpore nobilior], in which case it will contain eminently [continentur eminenter] whatever is in the ideas.” We have already noted two senses for Newton in which minds are plausibly “more noble” than bodies: they approach more fully the nature of substance, and they lack parts. So, Newton’s treatment of mental causation relies explicitly on the Cartesian assumption that minds are nobler than bodies and, for this reason, capable of eminently containing bodily perfections.

But what does eminent containment amount to for Newton? Some light is shed on this by one other appeal to the notion in *De Grav*. After defending the metaphysical and theological coherence of his theory of body, Newton once again goes on the offensive against Descartes. Newton raises the objection that, if the Cartesian distinction between thinking
and extended substances is “legitimate and complete,” then “God does not eminently contain extension within himself and therefore cannot create it” (*De Grav* 31). Why does Cartesian dualism preclude eminent containment? Newton writes,

> If on the contrary extension is eminently contained in God, or the highest thinking being, certainly the Idea of extension will be eminently contained within the Idea of thinking, and hence the distinction between these Ideas will not be so great [*non tanta erit*], indeed so that it would be possible for both [*quīn ut amīæ possint*] to coincide in the same created substance, that is for bodies to think or for there to be extended thinking things. (ibid.)

If we insist on a stark separation between thinking and extended substance, then we must prohibit even eminent containment and so render interaction unintelligible: “there is so great a distinction between the ideas of thought and of extension it is not obvious that there is any basis of connection or relation [between them]” (*De Grav* 34).

Whether this charge sticks depends on how literally eminent containment is construed. The problem is avoided by Scholastic authors like Francisco Suarez and Thomas Aquinas for whom the eminent containment of $p$ reduces to the power to produce $p$. To say our minds eminently contain motion, for example, means simply that we can move bodies. While such a conception avoids blurring the dualist categories, it seems merely to stipulate rather than explain mind-body interaction. Descartes’ own conception is unclear. He seems to adopt a more realist understanding, whereby eminently containing $p$ implies actually being or possessing $p$ (although perhaps not in a way that is evident). What is clear is that Newton himself must conceive eminent containment in realist terms; otherwise, his objection to Cartesian interaction would be otiose, for attributing to God the bare power to produce extension or motion in no way violates the strict Cartesian separation between mind and body. In other words, Newton’s charge that extension and thought will “really coincide” in a single substance follows only if eminent containment is actual containment.

But if Newton understands the causal principle in realist terms, requiring actual containment of the effect in the cause, doesn’t that leave him with the very same difficulties explaining mind-body interaction as Descartes? Let’s consider the two causal directions in turn.

(a) **Newtonian Mind→Body Causation**

As discussed above, mental causation is essential to Newton’s theory of body. This theory is consistent with his realist version of Descartes’
causal principle because, on the Newtonian view (as I have construed it), all God does in producing matter is delegate to determinate quantities of extension the power to stimulate human perceptions. But since there is no question that God himself actually contains this power—“it is certain that God can stimulate our perceptions by means of his own will”—the strong version of the causal principle is satisfied (De Grav 28). The solution is parallel but more limited in the case of finite minds. We cannot create bodies, not even our own bodies. But we are able to move our own bodies to which we are united “by divine constitution” (De Grav 30). That is, just as we can conjure ideas at will in our own imaginations, we can voluntarily make successive parts of space produce perceptions of our body in ourselves and in others, though we do this “not by a proper and independent power but by laws imposed on us by God” (De Grav 30). Neither solution requires our minds actually to contain extension or motion, only the power to produce ideas. In effect, Newton avoids the Cartesian problem of mental causation by embracing a quasi-idealistic ontology of matter.

(b) Newtonian Body→Mind Causation

Since bodies are less noble than minds, how can they contain formally or eminently what is in the perceptions they produce, as the causal principle demands? In the 1648 Comments, Descartes is driven by this difficulty to the conclusion that external bodies merely “give the mind occasion to form” innate sensory ideas:

Nothing reaches our mind from external objects through the sense organs except certain corporeal motions. . . . But neither the motions themselves nor the figures arising from them are conceived by us exactly as they occur in the sense organs. . . . Hence it follows that the very ideas of the motions themselves and of the figures are innate in us.

The problem as Newton sees it is that, by reducing bodies to extension alone (figures and motions), Descartes eliminates “the power or faculty by which they stimulate the perceptions of thinking things” (De Grav 34). But on Newton’s alternative theory, God directly attributes this power to select quantities of extension. And he notes that, since the proximate causes of our ideas, the “subtle parts of the brain,” are continually recycled, it is “manifest that the capacity is in all bodies” (ibid.). So, Newtonian bodies do not need to contain perceptions eminently in order to act on minds since they contain them formally and essentially. In more precise Cartesian terms, appearing certain ways to properly situated minds is the principal attribute of Newtonian bodies.
5. The Sensorium Dei

The famous correspondence between G. W. Leibniz and Newton’s representative Samuel Clarke was triggered at least in part by the 1706 Latin edition of Newton’s Opticks, where Leibniz was astonished to read that objects are perceived and moved by God “as it were in his sensory [tanquam sensorio suo].”47 In his opening salvo, Leibniz comments wryly that natural religion in England must “decay very much” considering that “sir Isaac Newton says that space is an organ which God makes use of.”48 But this misses the point of Newton’s analogy, as Clarke emphasizes: “The word sensorium does not properly signify the organ but the place of sensation.”49 Objects are directly known to God, in lieu of organs or representative ideas, because they exist in his ‘sensory field.’ Just as animals directly perceive the “sensible species” arriving in their sensorium via the sense organs and nerves, God “sees the things themselves intimately, and thoroughly perceives them and comprehends them wholly by their immediate presence to himself.”50

But besides Newton’s pantheistic assimilation of absolute space to God’s sensorium, Leibniz was also puzzled by the suggestion that God perceives bodies simply by their immediate presence: “More is required than bare presence to enable one thing to represent what passes in another . . . some sort of influence.”51 More illuminating than Clarke’s unhelpful reply to Leibniz—he says God perceives bodies by “being a living and intelligent as well as an omnipresent substance”52—is the De Grav model of sensation just discussed. Since, according to condition (3), bodies arouse sensations by their very nature, they do not have to act on the soul but merely be present to it in the sensorium. Whereas God’s sensorium occupies infinite space, ours is confined to the brain. But as long as information about the world is conveyed by the senses into the brain, the soul will experience the appropriate sensations. As noted, Newton takes this as evidence that the capacity to evoke sensations is in all bodies since the parts of the brain “are in a continual flux” (De Grav 34). Contrary to Leibniz, Newtonian sensation does not require an “influence”: God has created bodies so that to be perceived it is enough for them to be in the presence of a mind.

The sensorium analogy is also used in the Opticks to explain God’s direct power over bodies. We recognize within ourselves the power to produce and manipulate our own ideas, both directly with the intellect and imagination and indirectly by moving our own bodies. By this same means, God is able to produce sensory ideas in any mind at all since he “is able to move all bodies within his boundless uniform sensorium and thereby form and reform the parts of the universe.”53 God is to bodies as
finite minds are to their ideas: “he is no more the soul of them [bodies] than the soul of man is the soul of the species of things carried through the sense organs into the place of sensation where it perceives them by means of its immediate presence.” This highly unorthodox analogy makes good sense in connection with the De Grav account of voluntary movement sketched above. On that account, the divine mind does not transfer motion to bodies but instead wills that various regions of space give rise to sensations, just as we freely produce and manipulate vivid ideas in the space of our imagination. Like De Grav, the Opticks encourages us to think of mind-body causation as the voluntary eliciting of sense experience, immediate and universal in the case of God, mediated and limited in the case of man.

6. Conclusion

In the paragraph of De Grav that transitions from physical to metaphysical analysis, Newton makes his Cartesian target very explicit: “I consider it most important to overthrow its views of extension, in order to lay a truer foundations of the mechanical sciences” (De Grav 21). The problem with the Cartesian philosophy is not the distinction between thought and extension per se but the identification of extension with body. Newton transforms Cartesian extension into absolute space and fashions an occasionalist theory of body suitable to his voluntarism. His boast that this alternative conception of body “involves the principal truths of metaphysics, and thoroughly confirms and explains them” (De Grav 31) is not entirely unwarranted. God and finite minds are brought into space but remain absolutely incorporeal and indivisible substances united to bodies by divine constitution. This solution to the mind-body problem anticipates George Berkeley, while relying on a theory of causation at the heart of Cartesian metaphysics.

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NOTES

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2. Earlier studies: Burtt (1952), chap. 7; Koyré (1957), chaps. 7, 9, 10, and 1965; Baker (1930), chap. 4. See also Jammer (1954), chap. 4; Von Leyden (1968), chap. 12; Grant (1981), chap. 8. Notable contributions to the resurgence include McGuire (1982, 1990); Carriero (1990); Stein (2002); Janiak (2008); Slowik (2009).
3. *Opticks*, Queries 28 and 31 (Newton 2004, 130, 138). Burtt speculates in passing that Newton may have taken the mind to be extended (contrary to René Descartes) and located it in the brain but concedes that he “never states his conviction on the fundamental issue” (1952, 237). Koyré (1957) says nothing about Newton’s concept of mind, nor does Baker (1930), Westfall (1962) or Von Leyden (1968). A later Koyré study (1965) takes account of *De Grav* (then newly published), indicating that Newton takes the divine mind to be wholly present in all the parts of space just as human minds are wholly present in various distinct parts of the body (91); but Koyré does not take up the nature of the mind itself or its interaction with the body. In his well-known biography, Westfall mentions in passing (1980, 303–4) that Newton thought he could better account for mind-on-body causality than Descartes but does not explain why Newton thinks this.

4. *De Grav* was probably written a few years before the appearance of the *Principia* (1687). The Halls originally dated the work between 1664 and 1668 (Newton 1962, 90). But Dobbs’s more thorough consideration suggests a much later year, perhaps 1684 or 1685 (1991, 144).

5. For discussions of *De Grav* that emphasize the dynamical criticisms of Descartes’ physical concepts, see Stein (1967) and DiSalle (2006).

6. All page references to *De Grav* are to the recently republished Janiak edition (Newton 2004, 12–39), which slightly revises the Halls’ (1962) translation. Any significant departures I make from the Janiak translation are noted.

7. The valuable discussions of *De Grav* provided by McGuire (1978a and 1990) and Carriero (1990) do not address the mind-body relation in any detail. As discussed further below, Stein (1990 and 2002) maintains that Newton replaces the traditional substance ontology of mind and body with an ontology of mental and physical attributes but says little about the interaction between these attributes. Janiak (2008) explains Newton’s rejection of Cartesian dualism but not the important role that the problem of interaction plays in this rejection and in Newton’s alternative account the mind-body relation. Slowik (forthcoming) notes the relevance of Newton’s views on mind-body interaction for his overall ontology but does not analyze these views; like nearly every recent commentator on *De Grav*, he is primarily concerned with the ontology of space (and time).

8. Shifting slightly from the agnosticism of the first edition of the *Essay*, in the second and subsequent editions Locke ventures that “we might be able to aim at some dim and seeming conception of how matter might at first be made” (*Essay* IV, x, 18; 1975, 628). But he ventures no further. Thirty years later, in the second edition of his French translations of the *Essay*, Pierre Coste (Locke 1729, xliiv) reveals that Newton told him directly that he was the source for Locke’s “dim and seeming” conception of the creation of matter. For details and discussion, see Bennett and Remnant (1978), Conn (1999), and Hill (2003).

9. Thus, Newton emphasizes “I did not say they are numerical parts of space, which are absolutely immobile but only definite quantities” (*De Grav* 28).

11. Cf. Bennett and Remnant 1978, 9. Stein notes the crucial role of (3) in supporting a wholesale theory of creation (2002, 280), but he does not explain why (1) and (2) are not in themselves enough to deliver observable bodies, nor the radical implications of (3) for the ontology of bodies and the nature of mind-body interaction (which I will explain below).

12. Bennett and Remnant 1978, 8. Katherine Brading has developed a “law-constitutive” account of Newtonian bodies, according to which “a necessary condition for something being a body is that it satisfy certain laws” (2010, 13). But it is unclear how the laws of collision hinted at by Newton can constitute bodies any more than impenetrability can, for we cannot meaningfully conceive that bodies are “reflected in accordance with certain laws” (De Grav 28) unless we already have bodies distinguished from space. Willing that regions of space be subject to such laws no more gives us bodies than willing the same regions be impenetrable. That is why (3) is crucial on my view. In their recent papers on the supposed Lockean version of Newton’s theory of creation, neither Conn (1999) nor Hill (2003) consider the role of (3) but instead focus entirely on impenetrability and mobility.

13. “Whether you consider divine action or corporeal nature, to remove this [capacity to arouse perceptions in minds] is no less than to remove that other faculty by which bodies are enabled to transfer mutual actions from one to another, that is, to reduce body into empty space” (De Grav 34). The “other faculty” seems to be impenetrability since, when it is first introduced, it is said to explain why “oppositions obstruct their mutual motions and they are reflected in accord with certain laws” (De Grav 28). So, to remove (3) is ipso facto to remove (2) and undermine the very distinction between bodies and space.

14. Again: “you can see how fallacious and unsound the Cartesian argumentation is, for when the accidents of bodies have been rejected, there remains not extension along but also the capacity by which they stimulate various perceptions in the mind by means of various bodies” (De Grav 35).

15. In the discussion of the Third Rule for Natural Philosophy in the Principia, Newton says that we know bodies are impenetrable and movable “not by reason but by our senses” (1999, 88), suggesting that the power of bodies to stimulate sensations is epistemically as well as conceptually prior to their impenetrability and mobility.

16. Newton’s conception of bodies is, therefore, not quite the same as George Berkeley’s. Nevertheless, they avoid in similar fashion the difficulty of accounting for ex nihilo creation, a virtue of his system that Berkeley touted (Principles of Human Knowledge, 92; 1948–57, 2:81). The Newton/Berkeley parallel is also noted by Hall and Hall (Newton 1962, 81). Much earlier, Thomas Reid speculated that Locke’s embrace of the Newtonian theory indicated that Locke had “a glimpse of that system which Berkeley afterwards advanced” (Intellectual Powers, Essay II, chap. 10; 1872, 1:286) For discussion of Reid’s conjecture, see Woolhouse (1982). For a reading that distances Newton from Berkeley, see Stein (1970, 284).


19. Dempsey 2006, 425, 438; and 2009, 49; Janiak 2008, 164. Hall and Hall suggest that for Newton “there can be no complete distinction between thinking entities and extended (that is material) ones” (Newton 1962, 82). Iliffe asserts that for Newton, “Extension and thinking were not separate substances, since otherwise we would have to say that mind had no extension and so existed nowhere” (1995, 452). Slowik regards Newton’s insisting on the extension of God as an effort to “blur, or minimize, any sharp distinction between mind and body” (forthcoming, 16).

20. See also the unpublished work “Tempus et Locus”: “Neither does place argue for the divisibility of a thing or the multitude of its parts, and on that account imperfection, since space itself has no parts which can be separated from one another” (McGuire 1978b, 117); “Scholium” on Space and Time: “Just as the order of the parts of time is unchangeable, so too, is the order of the parts of space. Let the parts of space move from their places, and they will move (so to speak) from themselves” (Newton 1999, 66). For philosophical analysis of Newton’s argument, see Koslow (1976) and Nerlich (2005).


22. There is appeal to a similar analogy in the Enneads of Plotinus: “Think of a sound passing through the air and carrying a word; an ear within range catches and comprehends; and the sound and word will strike upon any other ear you may imagine within the intervening void. . . . Now the sound was diffused throughout the air not in sections but as one sound, entire at every point of that space. . . . Why, then, need we hesitate to think of soul as a thing not extended in broken contact, part for part, but omnipresent within the range of its presence, indwelling in totality at every point throughout the All?” (Ennede 6, Tractate 4, sec. 12; 1969, 528).

23. Moreover, if minds were extended in the way space is, then if God created a world consisting only of finite minds, each of these would have a certain size and shape. Koslow attempts to derive a contradiction from the Newtonian doctrine of the spatial diffusion of time, but his derivation wrongly assumes that “the spatial part of a part of time is supposed to be a part of time” (1976, 239). Although we can perhaps speak of the different “spatial parts” of a given moment, these are not temporal parts of time, like distinct moments, but simply distinct locations of one and the same time. As Newton says, we have no conception of the temporal parts of a given time.

24. 1999, 94.
25. 1999, 942. See also the *Opticks*, where God is said to be “incorporeal” (2004, 130) and “void of any members or parts” (2004, 138). So, it is hard to accept Janiak’s recent assertion that “Newton takes the mind to be an extended substance just as surely as the body is” (2008, 177). Likewise, it is misleading to say that Newton “takes metaphysical objects such as God and the mind to be physical” (ibid., 164n7) since Newton explicitly denies that minds are extended in the way bodies are.

26. AT 7: 85; CSM 2: 59. In the early notebooks Newton draws out some alleged absurdities of supposing the soul to be “nothing but modified matter”: we could not recall things at will and things would appear double or behind us (Newton 1983, 449–51). He also opines that the diversity of men’s tempers “arises from their bodies, for their souls are all alike” (ibid., 449). For further discussion, see Iliffe (1995). Dempsey (2006) takes Newton’s possible mortalism (the theological heresy that the soul dies with the body, only later to be resurrected) as also indicating mind-body monism. However, it does not follow from the fact that if the soul is immaterial (much less nonspatially extended), it is must be immortal. As Dempsey himself notes (2006, 426), Newton’s friend Locke radically separates the theological question of mortality from the metaphysical question of immateriality: “All the great ends of morality and religion are well enough secured, without philosophical proofs of the soul’s immateriality; since it is evident, that he who made us at the beginning to subsist here, sensible intelligent beings, and for several years continued us in such a state, can and will restore us to the like state of sensibility in another world, and make us capable there to receive the retribution he has designed to men, according to their doings in this life” (*Essay IV*, iii, 6; 1975, 542). Similarly, Descartes cautions in the “Preface” to the *Meditations* that his proof of the real distinction between the mind and body can at best provide only the ‘hope’ of immortality (AT 7: 13–14; CSM 2: 10; see also: AT 4: 283; CSMK 263 and AT 4: 333; CSMK 277).

27. Here is an important difference from the position settled on by Newton’s Cambridge contemporary Henry More. In his *Enchiridium Metaphysicum* (1679), More allows that God and minds are extended in the sense of (ii): “I gladly acknowledge every being as being to be extended in some way, God himself not accepted, but not all extended in merely mathematical or simple dimensions, but that dimensions of this sort are however included by some reason in those more spiritual extensions” (1995, 68). More arrived at the more robust sense of divine extension late in life, repudiating his earlier view that is closer to the one found in Newton. See Reid (2007) for details.

28. Failing to distinguish between (ii) and (iii) can lead to the mistaken conclusion that God and minds have shape. Thus, Funkenstein writes, “Newton distinguished between corporeality, which God lacks if he is to penetrate all things, and dimensionality, which every entity qua entity must have” (1986, 25). But Newton is clear that minds, though they have locations, no more have dimensions or shape than moments of time do.


31. That Newton intends to reform, rather than jettison, the notion of substance is indicated by his comment about condition (b): “although philosophers do not define substance as an entity that can act upon things, yet everyone tacitly understands this of substances” (De Grav 21).

32. When he considers the senses of substance relevant to Newton, Janiak neglects sense (a) and is therefore led to conclude, incorrectly I think, that bodies count as substances no less than minds and that space counts as substance not at all (2008, 141; see also 164).

33. Newton 1983, 463. Descartes relies on the principle frequently, perhaps most prominently in the first Third Meditation proof of God's existence: “the ideas in me are like <pictures or> images which can easily fall short of the perfection of the things from which they are taken, but which cannot contain anything greater or more perfect” (AT 7: 42; CSM 2: 29). But see also AT 7: 104; CSM 2: 76; AT 7: 104; CSM 2: 78; AT 7: 165; CSM 2: 116; AT 8A: 11; CSM 1: 198. For detailed discussion, see O'Neill (1987), Gorham (2002, 2003), and Schmaltz (2008, chap. 2).


35. AT 5: 347; CSMK 375. See also AT 5: 403–4; CSMK 381. Newton might have been aware of Descartes' remark since it is included in the 1662 edition of More’s Collected Philosophical Writings, which Newton may have used when he wrote notes on More in his Philosophical Notebooks. See McGuire and Tamny (1983, 59). It is worth noting how similar is the letter by More to Newton's phrasing about God and all things having their own “manner of being extended.” Cf. Reid 2007, 92.

36. AT 7: 79; CSM 2: 55. Throughout De Grav, Newton employs Cartesian terms of art, such as “clear and distinct,” “general extension,” and “mind-body union,” in their exact sense. His study of Descartes’ Principles and other works dates to his undergraduate days in the mid-1660’s, when he used the 1656 Amsterdam (Elzevir) edition of Descartes’ Opera. For a thorough review of Newton's early study and analysis of Descartes, see McGuire and Tamny (1983, chap. 2). See also Harrison (1978, 131–32) and Westfall (1962). Stein (1967) and Koyré (1965, chap. 3) offer detailed discussions of the relation between the physics of Descartes and Newton, including their respective conceptions of space and time. Recently, McGuire (2007; see also McGuire and Tamny 1983, chap. 2) has argued forcefully that Newton's acceptance of the actual infinity of space and time is grounded on a Platonic conception of true and immutable natures derived from Descartes.

37. Descartes also held that the mind is “beaucoup plus noble” than the body (AT 4: 292; CSMK 265) and could for this reason asymmetrically contain corporeal perfections (AT 7: 79; CSM 2: 55). For him, the simplicity of the mind seems to be the reason for its nobility: “it is a greater perfection to be undivided than to be divided” (AT 7: 138; CSM 2: 99).
38. I have altered the (2004) translation by Janiak (and Johnson), which is as follows:

But if on the contrary extension is eminently contained in God, or the highest thinking being, certainly the Idea of extension will be eminently contained within the Idea of thinking, and hence the distinction between these Ideas will not be such that both may fit the same created substance, that is but that a body may think and a thinking thing be extended. (De Grav 31)

Aut contra si Extensio in Deo sive summo ente cogitante eminenter contineatur, certe Idea Extensionis in Idea Cogitationis eminenter continebitur, et proinde distinctio Idearum non tanta erit quin ut ambe possint eadem creatae substantiae competere, hoc est corpora cogitare vel res cogitantes extendi. (Hall and Hall in Newton 1962, 109)

Janiak and Johnson’s rendition of the second half of the sentence is surely a distortion. Newton is not inferring from the containment of extension in divine thought that, therefore, the distinction will not allow thought and extension to coexist in the same thing. This would be a strange way to reason and would not raise any difficulty for Cartesian dualism. He is inferring rather that, since the distinction between thought and extension would not be so great (non erit tanta) if God eminently contained extension, this would allow thought and extension to coincide (which is what the final clause says explicitly). This inaccurate translation seems to have misled some commentators. For example, Dempsey takes it to imply that for Newton “mind and body are not only causally, but ontologically coupled”—a “prescient gesture toward mind-body substance monism” (2006, 425; see also 2009, 49). But the passage says nothing about Newton’s own view of the ontology of mind and body: it is an attempted reductio of Descartes’ form of dualistic interactionism.

39. Suarez himself was sensitive to this problem with reductionist analyses of eminent containment: “Not that formally speaking, and in the strictness of definition, the power to bring things about is to be identified with containing them eminently: we can make a distinction of reason between these two notions, and we believe that the following causal locution is a true way of putting the matter: since it contains the perfections eminently, if follows that it can bring them about” (Metaphysical Disputations 30, 10, 1; 1998, 34).

40. Descartes frequently invoked the notion of eminent containment, most crucially in the Third Meditation proof of God’s existence (AT 7: 41; CSM 2: 22) and the Sixth Meditation proof of material things (AT 7: 80; CSM 2: 55). The basic idea is that comparatively great or eminent causes can contain the reality or perfection they produce in their not-so-great effects in a way different from how those perfections are contained in those effects. There is formal containment, which corresponds to our ordinary perceptions, and eminent containment, which does not (AT 7: 161; CSM 2: 114). Bodies “f-contain” shape and motion, for example, but minds can at most “e-contain” them.

41. For he says his causal principle is “no different” from the common notion ex nihilo nihil fit: “if we admit that there was something in the effect which was
not previously in the cause, we shall have to admit that this something was made by nothing” (AT 7: 135; CSM 2: 97). This makes sense if the causal principle requires actual precontainment of the effect: if the principle is violated, then reality of the effect appears from nowhere. But if precontainment is merely power to produce, it is hard to see why the *ex-nihilo* principle is relevant: impotence is not mere nothingness. Nevertheless, a majority of commentators, including O’Neill (1987) and Schmaltz (2008), regards eminently contained properties as somehow reducible to formally contained properties like excellence or power. Only a minority of commentators—e.g., Broughton (1986) and Gorham (2003)—defends a more realist notion of eminent containment.

42. Gabbey (2002, 347) provides a similar account of Newton’s criticism, though he does not address the nature of eminent containment in detail.

43. Note that the issue of precontainment does not seem to arise for space and time themselves, even though Newton says that God is “as it were the emanative effect of God” (*De Grav* 21). In my view, defended elsewhere (Gorham 2011), space and time are not really distinct from God, so there is no question of God having to “give” himself his own attributes. So, since emanative causes are immanent, eminent containment is irrelevant.

44. Tamny has also noted the strong analogy between divine causality and the power of the human imagination (1979, 51–53).

45. So, Westfall is right that “whereas Descartes’ distinction separated mind and body, his [Newton’s] allowed them to combine” (Westfall 1980, 304). But this is not because Newton allows minds to be extended but rather because he makes bodies to be merely active powers of a sort manifestly contained in minds.

46. AT 8B: 358–59; CSM I: 304. For detailed discussion of this passage, see Gorham (2002).

47. Newton 1706, 315. In later editions, this becomes Query 28 (see, for example, Newton 2004, 130). For discussion, see Koyré and Cohen (1961).


51. Leibniz 2000, 8.

52. See also Clarke’s reiteration of this model of perception in the *Correspondence* with Leibniz (2000, 5, 20, 75).

53. Newton 2004, 138. The conception of space as the frame of God’s sensory awareness and the arena of his activity is asserted earlier in the (ca. 1690) manuscript “Tempus et Locus”: “understanding everything to the utmost, freely willing good things, by his will affecting all possible things, and containing all other substances in Him as their underlying principle and Place; a substance which by his own presence discerns and rules all things, just as the cognitive
part of man perceives the forms of things brought into the brain and thereby governs his own body” (McGuire 1978b, 123).


55. It is an interesting question what respective roles God and finite agents play in producing the motions of human bodies. Newton seems to hold both that God creates and moves all bodies (according to certain fixed laws) and that humans move their own bodies. Gabbey (2002) provides a brief but rich discussion of the question. This perennial problem of medieval theology reemerges in other modern thinkers such as Descartes (see Hattab 2007) and Berkeley (see McDonough 2008).

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