The Discreteness of Matter

Leibniz on Plurality and Part-Whole Priority

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Leibniz argues against Descartes's conception of material substance based on considerations of unity. I examine a key premise of Leibniz's argument, what I call the Plurality Thesis—the claim that matter (i.e., extension alone) is a plurality of parts. More specifically, I engage an objection to the Plurality Thesis stemming from what I call Material Monism—the claim that the physical world is a single material substance. I argue that Leibniz can productively engage this objection based on his view that matter is discrete. The discreteness of matter provides two aspects of support for the Plurality Thesis. First, it indicates that the parts of matter do not share boundaries and are, therefore, independent in an important sense. Second, it indicates that the parts of matter are determinate and are, therefore, ontologically prior to the wholes they compose.

1. Introduction

Leibniz argues against the Cartesian conception of material substance, that is, the view that matter consists in extension alone, based on considerations of unity. Leibniz's Argument from Unity, as I will call it, can be rendered as follows:

(1) Matter (i.e., extension alone) is a plurality of parts to infinity.
(2) A plurality of parts cannot be a true unity.
(3) A substance must be a true unity.

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Therefore,

(4) Matter (i.e., extension alone) is not a substance.[1]

Leibniz's use of the term "matter" in this argument refers both to *material stuff in general*, thus the entire physical plenum, and to *particular material things*, that is, objects typically taken to be material substances, rocks, tables, motorcycles, and the like. The Argument from Unity is, therefore, a general indictment of the substantiality of purely material things.

This argument, or, at least, nearly-identical arguments, can be found in Leibniz's texts from as early as the 1670s until as late as 1714; it is a staple of his metaphysical program.[2] Despite the prevalence of this argument in Leibniz's texts, and the corresponding prevalence of discussions of it in the secondary literature, certain important aspects of the argument remain underdeveloped. In particular, I will consider how Leibniz supports Premise (1) Matter (i.e., extension alone) is a plurality of parts to infinity—what I will call the *Plurality Thesis*. More specifically, I will consider how Leibniz supports the Plurality Thesis in light of challenges stemming from certain types of monism.[3]

Versions of monism have been around since Parmenides and continue to pop up in present-day discussions.[4] The type of monism I have in mind in connection with Leibniz's Argument from Unity is what I call *Material Monism*. According to Material Monism, the entire physical world is a single material substance. Although certain regions of the physical world might have different features from other regions, the physical world has no parts properly speaking, that is, regions that can exist independently of the whole.[5] To put the point in early modern terminology, regions of the physical world differ only modally from

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1. One text that supports this particular rendering is from Leibniz's *New System*: "After much reflection, I perceived that it is impossible to find *the principles of true unity* in matter alone [*la matiere seule*], or in what is only passive, since everything in it is only a collection or aggregation [*collection ou amas*] of parts to infinity. Now, a multitude can derive its reality only from *true unities*, which have some other origin and are considerably different from points, which all agree cannot make up the continuum. Therefore, in order to find these *real entities* I was forced to have recourse to a formal atom, since a material thing cannot be both material and, at the same time, perfectly indivisible, that is, endowed with a true unity" (GP IV, 478–79 = AG 139).

2. See, e.g., A 6.4, 1464 = Ar 257–59, GP IV, 478–79 = AG 139, A 2.3, 546 = Lo 73. This argument has received lots of attention in the literature, and I cannot reference all discussion here. For a representative sample, see, e.g., Sleigh (1990: Ch. 6), Levey (2003), Garber (2009: Ch. 2), and Arthur (2018: Ch. 1).

3. For further discussion of the role of the Plurality Thesis in Leibniz's Argument from Unity, including how Leibniz's Argument from Unity is vulnerable to objections stemming from certain types of monism, see, e.g., Harmer (2018).

4. For present-day versions, see, e.g., Schaffer (2010) and Horgan and Potrč (2008).

5. I use the term "region" as distinct from "part" in order to emphasize the dependence on the entire physical world. "Part" often brings a sense of independence or priority along with it.

one another; there is no *real*, that is, *substantial*, distinction between them.[6] A corollary of Material Monism, then, is the view that the entire physical world is *ontologically prior* to its regions. That is, each region depends for its existence on the entire physical world. Thus, Material Monism stands in stark contrast with a prevalent early modern commitment (shared by Leibniz) that material parts are ontologically prior to the wholes they compose.[7]

The picture of the physical world that Material Monism provides can be described as a *top-down conception*. This conception threatens to undermine the Plurality Thesis, since it straightforwardly denies that matter is a plurality in Leibniz's sense, that is, a collection of pre-existing parts. For the Plurality Thesis to stand, it requires what can be described as a *bottom-up conception* of the physical world, one that supports the contention that matter (i.e., extension alone) should be understood to be a plurality of pre-existing parts.[8] Furthermore, various recent papers have argued that Descartes's conception of the material world aligns with Material Monism.[9] If this is correct, then insofar as Leibniz's Argument from Unity is directed at the Cartesian conception of material substance, the argument would miss its mark entirely. This would be an unfortunate situation for Leibniz, since the Argument from Unity is one of his major lines of objection to Descartes's view, which, as I have mentioned above, can be found in texts spanning nearly Leibniz's entire life.[10]

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6. This way of expressing the view shows up in Leibniz's correspondence with Burcher de Volder. See A 2.3, 530 = Lo 61. See also Section 3 below for further discussion of De Volder's view. For elaboration of modal versus real distinction, see Descartes, *Principles* 1.60, AT VIII, 29 = CSMK 1, 213.

7. The distinction I am making here is similar, though not identical to the distinction Thomas Holden draws between the so-called "actual parts doctrine", according to which each part of a whole is a distinct existent in its own right (2004: 16–17), and the so-called "potential parts doctrine", according to which parts are *created* via division from a previously existing whole (2004: 17–18). Material Monism is different from the potential parts doctrine insofar as it makes the further claim that the "parts" that arise from "division" are not, strictly speaking, entities in their own right, but merely features or characteristics ("local variations" to use Horgan and Potrč's phrase [2008: 168]) of the entire physical world.

8. This point is also made by Harmer (2018: 92).

9. See, e.g., Gueroult (1984), Nelson and Smith (2010), and Sowaal (2004). For views rejecting the monist reading of Descartes, see, e.g., Rozemond (2011), Normore (2010), and Kaufman (2014).

10. It is worth noting certain features of the dialectical situation as it pertains to Leibniz's Argument from Unity in general and the Plurality Thesis in particular. If Material Monism is not Descartes's view, but instead, Descartes accepts Leibniz's claim that material parts are ontologically prior to material wholes—a view for which there is certainly textual evidence and which has been defended in the literature on this topic (see, e.g., Normore 2010 and Rozemond 2011)—then Leibniz's Argument from Unity already has some traction against Descartes and the need to defend the Plurality Thesis in terms of the discreteness of matter is not as central to Leibniz's case. This is how things unfold in, e.g., Leibniz's correspondence with Arnauld, who does not develop an objection to Leibniz's Argument from Unity in terms of Material Monism, but instead in terms of Leibniz's conception of substantiality, i.e., Premise (3) above. See A 2.2 153 = Vo 171.

This is all to say that a great deal of Leibniz's theory of substance depends on his ability to defend his position against challenges of this type. Although Leibniz himself does not encounter the challenge stemming from Material Monism until late in his life, his metaphysical system has the resources to engage it productively. As I will argue, Leibniz's view that matter is (and must be) discrete provides support for the bottom-up conception of the physical world needed to get his Argument from Unity off the ground.

Discreteness is a structural feature of matter: it concerns the relationships between the parts of a material thing. There are two important features of discreteness that I will develop. First, to say that matter is discrete means that the parts of a material thing do not share boundaries with one another, that each part has its own distinct boundary (even though there is no empty space between them), and that each part is itself made up of parts with their own boundaries. This supports the idea that the parts of matter are *independent* in an important sense, namely that they are capable of differential motions. Second, discreteness expresses a certain priority relation between parts and wholes; in particular, material parts are prior to the wholes they compose. As for why matter is discrete, I will suggest that, according to Leibniz, discreteness is an inevitable feature of concrete material existence. I will marshal this aspect of Leibniz's position in particular to address the challenge introduced by Material Monism. My approach will be both developmental, that is, I will track some of the major developments of Leibniz's conception of matter in order to show how he arrives at this position, and conceptual, that is, I will argue that the discreteness of matter is required to make sense of certain features of the material world.

In Section 2, I will develop the notion of discreteness, its origins and development within Leibniz's thought as well as its particular character. In Section 3, I will show how the conception of plurality that follows from matter's discreteness can be marshaled to address the challenge introduced by Material Monism: it supports both the plurality of matter and the priority of material parts to material wholes. Finally, in Section 4, I will explicate and defend a key commitment supporting Leibniz's view that matter is discrete, namely the idea that *to exist is to be determinate*. As I will show, this commitment is at the center of Leibniz's metaphysical project and it is, therefore, no surprise to find it standing behind

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For discussion, see, e.g., Sleigh (1990: Ch. 6). In fact, as I argue elsewhere, in such a dialectical context, Leibniz's Argument from Unity is best understood as applying to matter *qua* its divisibility, i.e., the argument will apply to both merely divisible matter (with merely potential parts) and to actually divided matter (with actually divided parts). See Harmer (2020). Still, Leibniz's reasons for asserting the discreteness of matter are more than merely dialectical, and as I hope will become apparent below, Leibniz's commitment to the discreteness of matter is important in its own right.

one of Leibniz's most powerful lines of argument against the Cartesian conception of material substance.

2. Discreteness: Origins and Development

Intuitively, something is discrete if it is broken apart or choppy, as opposed to smooth or without gaps, which would make it continuous. This intuitive rendering can be seen in the traditional distinction between discrete and continuous quantity, which is Aristotelian in origin. I will begin by showing that Leibniz understands the distinction between continuous and discrete in Aristotelian terms, that is, in terms of the parts of a thing sharing or not sharing boundaries, and that this distinction shapes Leibniz's conception of the nature of materiality.[11] This is more explicit in early texts, but a clear line can be drawn to later texts as well, especially if the order of development is considered. To support this contention, I will examine a representative sample of Leibniz's thought about matter from the late 1660s until the end of his life.

According to Aristotle, the distinction between discrete and continuous is an exhaustive and mutually exclusive distinction within the category of quantity. It applies to wholes, which is to say, anything with parts or capable of having parts, and sorts them according to the relations that hold between their parts—in particular, the structural relations (or perhaps, more anachronistically, the topological relations). Whether something is continuous or discrete is a function of whether or not its parts *share boundaries* with one another.[12]

Aristotle presents the distinction as follows:

> Of quantities some are discrete, others continuous. . . . Discrete are number and language; continuous are lines, surfaces, bodies, and also, besides these, time and place. For the parts of a number have no common boundary at which they join together. For example, if five is a part of ten the two fives do not join together at any common boundary but are separate; nor do the three and seven join together at any common

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11. My discussion of discreteness is largely indebted to Arthur (2001) and Levey (1999) and (2003b). My discussion differs from Arthur's and Levey's insofar as they are both focused on the notion of *continuity* in particular, while my focus is on *discreteness*. Furthermore, I add the idea that the role of discreteness is to undergird a bottom-up conception of the physical world.

12. See Levey (1999) for a discussion of the relationship between Leibniz's views about continuity and the topological notion of connectedness. Levey considers texts from the early 1670s, which contain views that Leibniz does not hold either before or after those years. I will emphasize the consistent thread from early to late.

boundary. Nor could you ever in the case of a number find a common boundary of its parts, but they are always separate. Hence number is one of the discrete quantities. . . . A line on the other hand, is a continuous quantity. For it is possible to find a common boundary at which its parts join together, a point. And for a surface, a line. For the parts of a plane join together at some common boundary. Similarly in the case of a body one could find a common boundary—a line or a surface—at which the parts of the body join together. (*Categories* I.6, 4$_b$20–5$_a$14; trans. J. L. Ackrill)[13]

From this text, we can extract basic characterizations of continuity and discreteness:

Continuity: a quantity is continuous just in case its parts have a common boundary.

Discreteness: a quantity is discrete just in case its parts have *no* common boundary.

In an early letter to Jacob Thomasius, Leibniz develops an account of the discreteness of matter that relies on an explicitly Aristotelian understanding of discreteness. Although many of the views Leibniz expresses in this letter are aspects of a rather grand reconciliation project between Aristotelian philosophy and mechanistic natural philosophy, a project that Leibniz does not continue to develop in these terms, many of the views that Leibniz expresses about matter in this letter persist.[14] An examination of this early letter, therefore, can provide some insight into Leibniz's later views.[15]

The task of Leibniz's stated reconciliation project is to explain Aristotle's principles in mechanical terms, that is, by appeal to only magnitude, figure, and motion.[16] He begins with the Aristotelian notion of primary matter, which

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13. In light of this passage from Aristotle, it appears that Leibniz is not only departing from the Cartesians by claiming that matter is discrete rather than continuous; he is departing from a longer philosophical tradition. Though the reason for why matter is a continuous quantity for Aristotle and the scholastic Aristotelians might differ from that of Descartes, insofar as quantity for Aristotelians is considered a proper accident of body—inalienable but not but not itself part of the essence. For further discussion, see Ariew and Gabbey (1998: 434). For Descartes's explicit identification of matter with continuous quantity, see *Meditation* 5, AT VII, 63 = CSMK II, 44.

14. Of course, Leibniz does continue to employ Aristotelian notions such as *form, entelechy*, etc. but Leibniz's later deployment of these notions differs from the attempt in this letter to explicate them in purely mechanical terms.

15. For a detailed and insightful discussion of the conception of discreteness, but especially its counterpart, continuity, in the letters to Thomasius, see Levey (1999: 82–85).

16. This is Leibniz's list. See A 2.1, 25 = L 94.

he reconceives to be "mass itself, in which there is nothing but extension and antitypy or impenetrability" (A 2.1, 26 = L 95). He argues that primary matter "is a being prior to all form, since it has its own existence. For whatever is in some space exists, and this cannot be denied of mass itself, even if it entirely lacks motion and discontinuity" (A 2.1, 26 = L 95). Primary matter, then, is a motionless, formless, and continuous mass. Leibniz notes further that primary matter "being continuous . . . is not cut into parts and therefore does not actually have boundaries" (A 2.1, 26 = L 95).[17] Noteworthy here is the connection Leibniz asserts between division and boundaries: he infers the absence of boundaries from the absence of cuts.

One especially difficult part of Leibniz's stated reconciliation project is accounting for Aristotelian forms in merely mechanical terms. Leibniz's approach to this problem is simply to reduce forms to figures or shapes. But for there to be figures or shapes in matter, Leibniz argues, matter must have boundaries. He writes,

> since figure is the boundary [*terminus*] of a body, a boundary is needed to introduce figure into bodies. But a discontinuity of parts is necessary in order to have a variety of boundaries arising in matter. For by the very fact that parts are discontinuous, each one will have separate boundaries [*terminos separatos*], since Aristotle defines the continuum as things whose limits are one. (A 2.1, 27 = L 95)

This passage contains important claims about the relationship between boundaries and discontinuity. Discontinuity, in particular "a discontinuity of parts"— just is the presence of separate boundaries—*terminos separatos*. This is Aristotle's understanding of discreteness, as Leibniz notes by contrasting it with how Aristotle characterizes continuity. Thus, for matter to have forms—that is, shapes—it must be discrete in the Aristotelian sense.[18]

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17. Leibniz will later reject the notion of primary matter, since, as he will later argue, continuous mass, being purely passive, cannot exist. See, e.g., A 3.7, 885 = Lo 9.

18. Leibniz will later argue that matter has no precise shape, another consideration which he uses against the existence of material substance. See, e.g., A 2.2, 250 = Vo 253. For discussion of Leibniz's view that bodies have no precise shape, see, e.g., Marshall (2011) and Levey (2005). I am sympathetic with Levey's view that bodies have *infinitely complex shapes*, so long as this is understood to mean, given Leibniz's views about the infinite, that they have *no shape whatever*, strictly speaking. This view about shapes will converge with Leibniz's considered account of discreteness because, since matter is actually infinitely divided, any boundaries possessed by the parts of matter will be vanishing—i.e., subject to further division—and so, in a sense, not really there. I return to the topic of shapes and the material world in Section 4 below.

The most important part of this early letter concerns Leibniz's account of how discontinuity is introduced into primary matter:

> discontinuity can be introduced into the formerly continuous mass in two ways—first, in such a way that contiguity is at the same time destroyed, when the parts are so pulled apart from each other that a vacuum is left; or in such a way that contiguity remains. This happens when the parts are left together but moved in different directions. For example, two spheres, one included in the other, can be moved in different directions and yet remain contiguous, though they cease to be continuous. (A 2.1, 27 = L 96)

Leibniz identifies two ways that discontinuity can be introduced, both of which involve motion.[19] The second scenario—"when the parts are left together"—seems to present more of a challenge for an account of how discontinuity is introduced. If the parts of matter cannot be "pulled apart from one another" but instead must be "left together", in what sense can they be discontinuous? Leibniz's response is that relative motion, even if the parts remain in contact, introduces boundaries into matter, boundaries which are not shared even by adjacent parts. Thus, although the parts will remain *contiguous*, they will no longer be *continuous*.[20]

The conclusion, then, of Leibniz's attempt to reduce forms to figures is as follows: "division comes from motion, the bounding [*termini*] of parts comes from division, their figures come from this bounding, and form from figures: therefore, forms come from motion" (A 2.1, 27 = L 96). Most important are the following two statements:

> *Division*: Division comes from motion.
> *Bounding*: The bounding of parts comes from division.

Although the stated reconciliation project does not figure among Leibniz's lasting commitments, the connection between motion and division, and between motion and bounded parts is a persistent feature of Leibniz's account of matter. *Division*, that is, the connection between motion and division has

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19. Leibniz considers two scenarios because in 1699 at least he holds that "neither a vacuum nor a plenum is necessary; the nature of things can be explained in either way" (A 2.1, 25 = L 94). So he is covering either case. Of course, since Leibniz will later uphold the plenum, the second scenario is more likely to have connections with his later views.

20. Aristotle characterizes contiguity as follows: "a thing that is in succession and touches is contiguous" (*Physics* 5, 227a10; trans. R. P. Hardie and R. K. Gaye).

been well documented in the literature.[21] What has not been emphasized is *Bounding*, that is, the connection between division and the bounding of parts. But it is this second claim, rather than the first, that provides the clearest connection between the discreteness of matter and both the plurality of matter and the bottom-up conception of the physical world that the Plurality Thesis relies on.

While Leibniz's conception of discreteness initially appears in the context of his physics and is, as I have described it, a structural feature of matter, as his thought develops it takes a decidedly metaphysical turn. Leibniz's views about matter become closely connected to his engagement with questions related to the composition of the continuum, which Leibniz himself characterizes as one of the two great labyrinths of human reason.[22] In trying to chart Leibniz's development on this point, one encounters a terminological labyrinth rivalling the philosophical labyrinth indicated by Leibniz. For this reason, I will introduce the following table of terminology, though its complete significance will not be apparent at first:

Terms Indicating Discreteness	Terms Indicating Continuity
Bounded Parts	Unbounded Parts
Assignable Parts	Unassignable Parts
Determinate Parts	Indeterminate Parts
Distinguished Parts	
Actual Parts	Potential Parts

This table provides pairs of terms that Leibniz uses to contrast the parts of continuous quantities with the parts of discrete quantities.[23] In the Thomasius letter, the first pair of terms is used to characterize the difference between discreteness and continuity. Primary matter is continuous, with *unbounded* (i.e., undivided) parts—or, in some sense, no parts at all. Matter, the matter that exists in the world around us, is discrete with *bounded* parts.

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21. See, e.g., Arthur (1989) and Levey (1998).

22. See, e.g., Grua 326 = AG 95: "there are two great labyrinths of the human mind, one concerning the composition of the continuum, and the other concerning the nature of freedom, and they arise from the same source, infinity." See, Arthur (2018) for a comprehensive discussion of Leibniz's engagement with the labyrinth of the continuum.

23. In certain cases, I have resorted to cognates of Leibniz's actual terminology for ease of expression. However, when I discuss the texts in which each pair of terms is found, I will note the exact words themselves.

In some notes from 1676, Leibniz again asserts the discreteness of matter. In the following passage, Leibniz's tone is tentative, and he flirts with the conclusion that, since matter is discrete, it is ultimately composed of points:

> Matter alone can be explained by a plurality without continuity. And matter seems in fact to be a discrete being. For though it is assumed to be solid, matter taken without a cement, through the motion of another body, for example, will be reduced to a state of liquidity or divisibility. Hence it follows that it is composed of points. This I prove as follows: every perfect liquid is composed of points, because it can be dissolved into points, namely, by the motion of a solid within it. Matter therefore is discrete being, not continuous. It is merely contiguous and is united by motion or by some mind. (A 6.3, 473 = L 158)

Note, in particular, the connection Leibniz suggests in the opening of this passage between plurality and discreteness. Matter is a plurality without continuity; matter is discrete. Furthermore, the sense in which matter is a plurality is made very explicit: matter is a collection of points.[24]

An important shift takes place later in the same year, a shift that introduces the second main component of discreteness noted above: the priority of material parts to material wholes. If the discreteness of matter is conceived as a resolution into points, it may follow that the parts of matter do not share boundaries (points, of course, are incapable of overlap), but it is difficult to see how points can be prior to wholes. After all, as Leibniz understands points, they are themselves mere boundaries or extrema of material things.

Later in 1676, Leibniz develops a model for discrete matter that does not entail its resolution into points. In the dialogue *Pacidius Philalethi*, Leibniz compares the division of matter to a folded tunic:

> It is just as if we suppose a tunic to be scored with folds multiplied to infinity in such a way that there is no fold so small that it is not subdivided by a new fold: and yet in this way no point in the tunic will be assignable [*assignabile*] without its being moved in different directions by its neighbors, although it will not be torn apart by them. And

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24. Note that the bounded parts that Leibniz is developing in these and later texts are not non-material substances, but material things. Thus the sense in which matter is an aggregate (as this relates to matter's discreteness) is that it is an aggregate of material parts, not an aggregate of substances. The latter notion comes to be how Leibniz articulates what he calls "second matter". See, e.g., Leibniz's 1698 letter to Bernoulli: "secondary matter, i.e. mass, is not a substance, but substances" (A 3.7, 885 = Lo 9). For further discussion of how matter is a plurality in the sense of *second matter*, see Arthur (2018: Ch. 2).

the tunic cannot be said to be resolved all the way down into points; instead, although some folds are smaller than others to infinity, bodies are always extended and points never become parts, but always remain mere extrema. (A 6.4, 556 = Ar 187)

The same relationship between motion and division is present here as in the Thomasius letter. More importantly, though, Leibniz formulates his commitment to the actually infinite division of matter in a way that avoids the conclusion that matter is composed of points. He claims that "there is no fold so small that it is not subdivided by a new fold". Consequently, every part of the tunic is assignable—*assignabile*—even though there is no end to the folds of the tunic. This provides a slightly different sense in which matter is a plurality: matter is a collection of assignable parts (but not points).

The tunic model is paired with another important result that Leibniz reaches in the 1670s concerning the different part-whole priority relations that obtain in continuous versus discrete wholes. Here, the discussion appears in a slightly different context (i.e., not primarily a discussion of material structure):

There can be no such thing as a fastest motion, nor a greatest number. For number is something discrete, where the whole is not prior to the parts, but the converse. There cannot be a fastest motion, since motion is a modification, and is the translation of a certain thing in a certain time—in short, just as there cannot be a greatest shape. There cannot be one motion of the whole; but there can be a kind of thought of everything. Whenever the whole is prior to the parts, then it is a maximum, as for example in space and in the continuum. If matter, like shape, is that which makes a modification, then it seems that there is not a whole of matter, either. (A 6.4, 520 = Ar 121)

Leibniz claims that in discrete things the parts are prior to the whole, while in continuous things it is the reverse. This means that the parts of matter (since matter is discrete) have to be, in some sense, independent of the wholes they make up and in fact prior to them. If the parts of matter were points, as Leibniz had previously argued, then the parts could not be prior to the whole because points are, as Leibniz explicitly says in *Pacidius Philalethi*, "mere extrema", that is, they are the endpoints of lines, which are the edges of planes, which are the surfaces of things—but things are prior to their surfaces, edges, and endpoints. Still, the parts of matter are assignable. And they are assignable precisely in virtue of their boundaries, which they do not share with their neighbors. The notion of an assignable part presented in *Pacidius Philalethi* is,

therefore, along the same trajectory as the notion of a bounded part from the letter to Thomasius.

In a May 1702 study, given the title "On Body and Force, Against the Cartesians", Leibniz uses the term "distinguished" to express the same commitment as expressed by the terms "assignable" and "bounded".[25] Once more, Leibniz's remarks are in the context of a discussion of extension. Having defined extension as "a diffusion or repetition of a certain nature", Leibniz continues,

> every repetition (or collection [*multitudo*] of things of the same kind) is either discrete, as, for example, in things that are counted, where the parts of the aggregate are distinguished [*discernuntur*], or continuous, where the parts are indeterminate [*indeterminata*] and one can obtain parts in an infinite number of ways. (GP IV, 394 = AG 251)

The contrast here is between parts that are distinguished—*discernuntur*—which pertain to discrete things, and parts that are indeterminate—*indeterminata*—which pertain to continuous things. The sense in which matter is a plurality, according to this text, is that matter is a collection of distinguished parts.

The emerging picture is further filled in in a 31 October 1705 letter to Princess Sophie. In this case, Leibniz highlights the fact that the parts of matter are *determinate*, given that matter is actually divided in a particular way in virtue of the actual state of the physical universe:

> we must say that space is not at all composed of points, nor time of instants, nor mathematical motion of moments, nor intensity of extreme degrees. That is, that matter, that the course of things, that finally all actual composites, is a discrete quantity, but that space, time, mathematical motion, intensity or the continual increase one conceives in speed and in other qualities, and finally all that which gives an estimate which ranges over possibilities, is a continuous quantity which is indeterminate [*indetermineé*] in itself, or indifferent to the parts one can take in it, and which are actually found there in nature. The mass of bodies is actually divided [*divisée actuellement*] in a determinate [*determineé*] manner, and nothing there is precisely continuous; but space, or the perfect continuity which is in the idea, represents nothing but an indeterminate possibility of dividing it as one would like. (GP VII, 562)

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25. Although this text is some 25 years from the 1676 notes, I think there is a clear connection, which is highlighted by the terminological distinctions introduced above.

Here the contrast between continuous and discrete quantity is elaborated in the context of distinguishing between actual and ideal things (here, "possibilities"). The reason Leibniz gives for attributing discrete quantity to actual things is that "the mass of bodies is actually divided in a determinate manner". In contrast, an ideal thing, which is a continuous quantity, "represents nothing but an indeterminate possibility of dividing it however one likes". So the contrast is between determinate parts on the one hand and indeterminate parts on the other.

A mere twenty days earlier, Leibniz has formulated a similar distinction in a draft letter to De Volder. The material in this draft can help to clarify what Leibniz means by determinate and indeterminate parts. He writes,

> In fact, matter is not continuous but discrete and actually divided to infinity, even if no assignable part of space is devoid of matter. Yet space, like time, is not something substantial, but something ideal, and consists in possibilities, i.e. the order of possible coexistents at any given time. And so, there are no divisions in it, except those that the mind makes, and the part is posterior to the whole. (GP II, 278 = Lo 327)

According to Leibniz, a continuum can be divided in infinitely many ways. Take, for example, a unit line segment. This can be divided into two half-unit segments; or into four quarter-unit segments; or into one half-unit segment and two quarter-unit segments; or into three third-units; and so on, indefinitely. Leibniz's point is that there is nothing about the unit line segment (and by extension any continuous thing) that dictates how it is to be divided—that is up to some observer to determine. Not so with discrete things. In discrete things everything is actually divided in a determinate manner. In other words, at any time there is an already-given structure of divisions, a way in which the parts are already assigned.

The contrast between indeterminate and determinate parts, then, has to do with whether or not there is an already-given structure of divisions or not. If there is, then what we have is a discrete whole, in which an observer can merely perceive the divisions that are already there. If there is no such structure, then what we have is a continuous whole, in which an observer can "create" divisions (at least, *in intellectus*), since there is no privileged structure of divisions among the infinitely many possible ones. The sense in which matter is a plurality in these two texts, then, is that matter is a collection of determinate parts. Notice how, in these texts, the notion of discreteness is connected with concrete existence. To be discrete is to be determinate, to have all structural features specified. To be continuous, by contrast, is to be indeterminate, to have certain structural features unspecified. Looming in the background is the very powerful idea that

to exist is to be determinate.[26] This suggests that discreteness is a requirement of concrete material existence.

This idea is drawn out clearly in a very well-known passage from a 19 January 1706 letter to De Volder. In this passage, Leibniz draws a distinction between actual and ideal things:

> In actual things there is nothing but a discrete quantity, namely the multitude of monads, i.e., simple substances, which in any sensible aggregate, i.e. any aggregate corresponding to the phenomena, is, indeed, greater than any number however large. But continuous quantity is something ideal that pertains to possible things and to actual things in so far as they are possible things. Of course, the continuum involves indeterminate [*indeterminatas*] parts, but, nevertheless, nothing is indefinite [*indefinitum*] in actual things. Indeed, any division that can be made in actual things has been made. Actual things are composed as a number is composed from unities, ideal things as a number is composed from fractions. There are actual [*actu*] parts in a real whole, but not in an ideal whole. Indeed, when we—confusing ideal things with real substances—seek actual parts [*partes actuales*] in the order of possible things and indeterminate parts in an aggregate of actual things, we entangle ourselves in the labyrinth of the continuum and in inexplicable contradictions. (GP II, 282–83 = Lo 333)

This text represents the culmination of Leibniz's thought over the preceding decades. Actual and ideal are correlated with discrete and continuous, respectively. Actual things (i.e., discrete things) are exhaustively divided into parts in a determinate way. There are parts already given, and prior to any wholes composed of them. Consequently, actual things (in this sense) are always aggregates—that is, collections. They only exist insofar as a multitude of actual parts exists. Ideal things (i.e., continuous things), by contrast, are not divided into parts and, as such, are indefinite in a certain respect. There are no parts already given, and the whole is prior to any parts that are subsequently divided out (division here being division *in intellectus*). Insofar as ideal things are possible things they do not have any concrete existence, but, as their designation indicates, are merely *entia rationis*.

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26. I will engage this very powerful, but also somewhat elusive idea at more length in Section 4 below. For a recent discussion of closely related issues see Wilson (2012). Wilson argues that "determinable properties might well be part of a (relatively) fundamental base" (2012: 15). Insofar as determinables involve indeterminacy in some sense, Wilson's conclusion seems to diverge from Leibniz's idea here.

The central point for the present investigation is this: continuity involves indeterminacy, while discreteness does not. This indeterminacy presents a problem for concrete existence, on Leibniz's view, because if the parts of a continuous entity are not already specified, if there is not already some built-in structure of divisions, then we are forced to conclude that the continuous entity is composed from points. But this leads to paradox, as Leibniz's sustained engagement with the Problem of the Composition of the Continuum makes clear.[27] In order to avoid the "inexplicable contradictions" that follow when "we entangle ourselves in the labyrinth of the continuum", Leibniz claims that concretely existing entities must be discrete, that is, have fully determinate structural features.

Leibniz is, therefore, committed to the following general claims: (1) for matter to actually exist is for it to be discrete, (2) to be discrete is to be a plurality, and (3) to be discrete is to have parts that are prior to the wholes they compose. To be sure, the metaphysical commitments in the background of this passage are very different from those operating in Leibniz's letter to Thomasius. But given the trajectory that I have followed from 1669, I think that the connection is clear: the physically bounded parts of the Thomasius letter are consonant with the metaphysically actual parts of the letter to De Volder; the latter is just a development of the former.

3. Discreteness, Plurality, and Part-Whole Priority

The developmental story just recited can be shown to support the two aspects of discreteness needed to support the Plurality Thesis. In this section, I will address the following two sets of questions. First, how does the discreteness of matter establish that matter is a plurality? In other words, how does the claim that material things have either bounded, assignable, distinguished, determinate, or actual parts give Leibniz license to conclude that material things are, properly speaking, pluralities? And second, how does the discreteness of matter support a bottom-up conception of the physical world? In other words, how does the claim that material things have bounded parts allow Leibniz to conclude that the parts of material things pre-exist the wholes they compose? I will address these questions in order.

Aside from the developmental story presented above, there are conceptual or philosophical reasons that discreteness and plurality are connected. Based on the account of matter's discreteness developed above, it is apparent that the

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27. One discussion of the various paradoxes engendered by taking a line to be composed from points spans many pages of Leibniz's dialogue *Pacidius Philalethi*. See A 6.4, 549ff. = Ar 173ff.

following claims from the Thomasius letter are persistent features of Leibniz's metaphysics of matter in some form or other:

> *Division:* Division comes from motion.
> *Bounding:* Boundaries come from division.

To more clearly see the connection between discreteness and the Plurality Thesis, more subtle versions of these claims are needed. In some sense, what I offer here is an important correction to Leibniz's own articulation of these commitments.[28] However, I think that attention to Leibniz's texts shows that what I say here is consistent with Leibniz's later formulations, even if not explicitly stated by Leibniz himself.[29]

In the early letter to Thomasius, Leibniz outlined a temporally ordered process in which *Bounding* follows from *Division*: continuous primary matter comes to have bounded parts through the introduction of motion. This cannot be the account that Leibniz has in mind in later texts. For one thing, in the Thomasius letter Leibniz is content to assert the existence of undivided, continuous primary matter. To quote Leibniz again, "whatever is in some space exists, and this cannot be denied of mass itself, even if it entirely lacks motion and discontinuity" (A 2.1, 26 = L 95). In later texts, Leibniz is clear that this conception of matter tracks only an abstraction, as shown by this statement to De Volder: "I think that that which is extended has no unity except in the abstract, namely when we divert the mind from the internal motion of the parts by which each and every part of matter is, in turn, actually subdivided into different parts . . ." (A 2.3, 546 = Lo 73). The conditions of concrete existence entail that matter is always already subdivided into different (and bounded) parts.

The fact that matter is always already subdivided slightly changes the meanings of *Division* and *Bounding* above. The locution "come(s) from" in *Division* and *Bounding* cannot indicate a causal relationship between motion, division, and boundaries. It is not right to say that motion causes division, and then division causes boundaries. Rather, it indicates that when you have one, you automatically

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28. My claims here also provide a correction to the literature on this topic, which often describes motion as *causing* divisions. See, e.g., Levey (1999: 86) and Arthur (2018: 39–48).

29. In later texts, Leibniz often mentions the actually infinite division of matter alongside the claim that each part has different motion from its neighbors, without explicitly stating that the motion is what causes the division. See, e.g., *Monadology* ¶65: "each portion of matter is not only divisible to infinity, as the ancients have recognized, but is also actually subdivided without end, *each part divided into parts having some motion of their own*; otherwise, it would be impossible for each portion of matter to express the whole universe" (GP 6, 618 = AG 221; emphasis added).

have the other.[30] Thus, it is more accurate to paraphrase *Division* and *Bounding* as "when you have motion, you automatically have division" and "when you have division, you automatically have boundaries", respectively.[31] This analysis suggests that division, motion, and boundaries are correlative notions for Leibniz. It also suggests that the discreteness of matter, a commitment that builds in *Division*, and *Bounding* above, is a general analysis of materiality. In other words, as I interpret Leibniz on this point, to be material (and to exist) is to be discrete.[32]

Consider the example of the two spheres that Leibniz presented to Thomasius.[33] If we try to understand the scenario in causal terms, that is, suppose that the motion of the smaller sphere causes the division of the two spheres and thus introduces a boundary (in fact, boundaries) where there were none before, the scenario ends up in confusion. The smaller sphere cannot move with respect to the larger sphere unless it *already has its own boundary*. If the boundary were shared, the smaller sphere would simply pull the larger one along with it. Relative motion, therefore, without gaps between the moving objects *relies on* discreteness or discontinuity; it cannot *introduce* it.[34]

It follows from the understanding of discreteness outlined so far that discreteness grounds a certain type of independence among the parts of material things and any wholes they might compose. Call the type of independence "independence with respect to motion":

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30. See GM 7, 19 = L 667, where Leibniz characterizes the notion of "ingredient [*ingrediens*]" in a similar way. Though I am not claiming that Leibniz is deploying his notion of ingredient here, it is nonetheless helpful to note that Leibniz explicitly formulates a notion that is very similar to the one I am attributing to him here.

31. I believe this is consistent with Leibniz's later texts, though not stated by Leibniz explicitly, since in many texts Leibniz does not explicitly claim that motion causes divisions. See Footnote 29 above.

32. I add the parenthetical "and to exist" because there remains a conception of *extension* (though not materiality) in Leibniz on which extension is continuous and therefore not plural. But, as I said above, this conception captures an abstraction or an idealization and cannot actually exist.

33. Recall: "For example, two spheres, one included in the other, can be moved in different directions and yet remain contiguous, though they cease to be continuous" (A 2.1, 27 = L 96).

34. Leibniz returns to the example of the spheres in a 1698 text *On Nature Itself* (G 4, 504–16 = AG 155–67). There he argues that relative motion cannot provide a basis for distinguishing the spheres: "not even an angel could find any difference between its [i.e., the sphere's] states at different times, nor have any evidence for discerning whether the enclosed sphere is at rest or revolves, and what law of motion it follows" (AG 164). This might seem to undercut the role of discreteness in grounding the plurality of matter, since this text seems to suggest that if matter is extension alone, there can be no distinction between material things. However, I see this text as consistent with the view I am developing here. To see how, this text must be considered in view of Leibniz's larger aim, namely to reject the Cartesian conception of merely extended substance. On Leibniz's considered view immaterial, mind-like, active substances are required to ground the existence of discrete matter. Thus, Leibniz is at no stage of his argument committed to the view that merely extended, but also discrete matter can exist. This is just to say that, according to Leibniz, the structure of matter itself calls out for a foundation in immaterial substances.

> *Independence with respect to Motion:* Two things, *a* and *b*, are independent with respect to motion just in case *a* can move without *b* moving in the same way, and *vice versa*.

As I have suggested, though not yet in these particular words, having distinct boundaries is a necessary condition of independence with respect to motion. That is, unless *a* and *b* have distinct boundaries, any motion of *a* will also be a motion of *b*, and *vice versa*. Thus, Leibniz's notion of material part (i.e., bounded, assignable, distinguished, determinate, or actual part) might be explicated as *part capable of moving independently*. Because the notions of division, motion, and boundary are correlative with respect to material things, this relies on matter's discreteness.[35]

Thus, as I see it, the discreteness of matter undergirds the Plurality Thesis by supporting the contention that matter is a plurality, but also by specifying the sense in which this is so. Now what about the connection between the discreteness of matter and the bottom-up conception of the physical world required by the Plurality Thesis? To address this question, I will turn to an objection to Leibniz's Argument from Unity raised by Burcher de Volder. De Volder objects to the Plurality Thesis by suggesting an alternative model of the physical world, one on which the world is a single, material substance. On De Volder's view the "parts" of matter are merely modes of the single, extended substance, not distinct things in their own right.[36] De Volder supports this suggestion by noting that in virtue of the impossibility of empty space (a prevalent early modern commitment), material parts depend on one another, that is, one part cannot exist without the entire material world existing. He then argues that this sort of dependence entails the unity of the entire physical world.

While granting Leibniz the point that material parts are independent with respect to motion, De Volder presents the following objection:

> For if there is indeed no empty space, as you submit, it will not be possible for one part, which anyone might imagine for themselves, to be conceived without the others. From this it seems to follow that there is

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35. This result supports views previously developed by Arthur (2018) and Levey (1998) according to which Leibniz's commitment to actually infinite division originates with an attempt to explain the possibility of motion in the plenum. See Descartes's *Principles* II.33–36 and Leibniz's comments on these articles at A 6.3, 214 = Ar 24–25 and GP IV, 370 = L 393. I differ from Arthur and Levey by claiming that discreteness grounds the *possibility* of motion, whereas they claim that motion causes divisions. So, I agree with Arthur and Levey that independent motion is central to the notion of actual part, but I think that there is a deeper explanation for this independent motion, namely matter's discreteness.

36. De Volder's suggestion has a great deal in common with Schaffer's *priority monism* and Horgan and Potrč's *blobjectivism*. See Schaffer (2010) and Horgan and Potrč (2008).

no real distinction [*reale discrimen*] between them, but that the distinction [*discrimen*] between parts that is imagined in these things consists not so much in a difference of substance as in a difference of modes [*quam in modum varietate consistere*]. (18 Feb 1699; A 2.3, 530 = LDV 61)[37]

De Volder is arguing from a global dependence among material parts to the conclusion that the distinction between them is not strong enough to establish the type of plurality that Leibniz wants.

Though I cannot fully engage De Volder's objection and Leibniz's attempts to reply here, I want to develop one key idea as it relates to the discussion of discreteness above. The viability of De Volder's objection hinges on the possibility that a material whole (namely, the entire material world) can be prior to its parts, that is, that a top-down conception of the physical world is viable. As I have developed it above, Leibniz's characterization of matter as discrete explicitly rejects this possibility. To exist and be material requires, on Leibniz's analysis, that material parts are prior to material wholes. Why is this? If things were otherwise, then material things would be indeterminate, their structures would not be entirely specified or determined at any given time. But this, according to Leibniz, is inconsistent with concrete material existence. Thus, even though material parts are not absolutely fundamental, they do enjoy a relative fundamentality when considered in relation to wholes they compose. In fact, they must, if the material world is to meet a crucial requirement of existence: to exist is to be *determinate*. Thus, material parts are *prior* to material wholes in just the sense required by the Plurality Thesis.

Consideration of De Volder's objection shows, therefore, that both aspects of discreteness are crucial to its role in undergirding the Plurality Thesis: matter must have parts that are independent of one another (i.e., that have separate boundaries), and matter must have parts that are prior to the wholes they compose. If either of these aspects of discreteness is neglected, it cannot play the role it needs to in providing support for the Plurality Thesis, and, in turn, cannot play the role it needs to in Leibniz's otherwise powerful Argument from Unity.

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37. De Volder provides different formulations of this argument. See, e.g., A 2.3, 562 = LDV 91. Also, De Volder's reasoning here is reminiscent of Spinoza in E1P15S, though De Volder does not mention Spinoza: "For if corporeal substance could be so divided that its parts were really distinct [*realiter distinctae*], why, then, could one part not be annihilated, the rest remaining connected with one another [*inter se connexis*] as before? And why must they all be so fitted together that there is no vacuum? Truly, of things which are really distinct from one another, one can be, and remain in its condition, without the other. Since, therefore, there is no vacuum in nature (a subject I discuss elsewhere), but all its parts must so concur that there is no vacuum, it follows also that they cannot be really distinguished [*realiter distingui*], i.e., that corporeal substance, insofar as it is a substance, cannot be divided" (G 2, 59 = C 423). For a detailed discussion of De Volder's objection see Harmer (2018: 72–84).

4. To Exist Is to Be Determinate

One objection that might arise to the account I have provided so far is that I take one controversial claim, that is, the Plurality Thesis, and rest it squarely on another (perhaps more) controversial claim, what I will call the *Determinateness Thesis*, that is, "to exist is to be determinate". Though I cannot provide a comprehensive defense of the Determinateness Thesis within the confines of the present paper, I will, in this final section, provide some indication as to why Leibniz holds this thesis. In fact, as I will argue here, the Determinateness Thesis is a commitment at the very center of Leibniz's metaphysical project. Thus, it is not surprising to find the Determinateness Thesis providing support for one of Leibniz's central arguments against the Cartesian conception of material substance.

There are two sets of questions pertaining to Leibniz's commitment to the Determinateness Thesis that I will discuss here. First, in what sense must existing things be determinate for Leibniz? What are Leibniz's reasons for thinking that to exist is to be determinate in this sense? And second, is this commitment consistent with other views Leibniz holds? In particular, is the Determinateness Thesis consistent with Leibniz's analysis of bodies, including the claim that bodies have no precise shapes? I will claim that the sense in which existing things must be determinate is that they must have *all features specified*. This is because, based on Leibniz's commitment to the Principle of Sufficient Reason and the Principle of the Identity of Indiscernibles, there must be a basis for God's discrimination between the features of the actual world and the features of all other possible worlds.[38] Next, I will claim that the Determinateness Thesis is ultimately consistent with other aspects of Leibniz's characterization of bodies.

The sense in which existing things are determinate for Leibniz is that they have all features specified. I have already motivated this idea as it pertains to the structural features of material things: to leave any indeterminacy in the structural features of material things is to induce paradoxes of the composition of the continuum. But Leibniz's commitment to the Determinateness Thesis can be found in other contexts within Leibniz's metaphysics as well. Consider, for example, Leibniz's distinction between complete and incomplete notions. In order to exist, the nature of a substance must be *complete*. *Incomplete* natures, by contrast, cannot exist without being further specified in some particular way. This is expressed in some of Leibniz's remarks on one of Arnauld's letters from 1686:

> Thus the concept of the sphere in general is incomplete or abstract, that is to say one considers in it only the essence of the sphere in general or in

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38. Of course, Leibniz's God does not create material parts, but immaterial monads, whose existence and perceptions provide a basis from which bodies result.

theory, disregarding singular circumstances, and consequently it in no way contains what is required for the existence of a certain sphere; but the concept of the sphere Archimedes had put on his tomb is complete and must contain everything that belongs to the subject of this form. This is why in individual or practical considerations, which revolve around singular things, beyond the form of the sphere there enters the matter of which it is made, the place, the time, and the other circumstances which by a continual concatenation would finally embrace the entire succession of the universe, if one could pursue everything these concepts contain. For the concept of this particle of matter of which this sphere is made embraces all the changes it has undergone and will one day undergo. And according to me each individual substance always contains traces of what has ever happened to it and marks of what will ever happen to it. (A 2.2, 45 = Vo 61–63)

Leibniz's claim is that a *sphere in general* cannot exist because certain of its features are left unspecified: its time, place, and mode of existence. Notice that Leibniz expresses the point by saying that the sphere in general *does not include what is required for existence*.

The ultimate basis for Leibniz's requirement that the notions of existing things must be complete is his commitment to the Principle of Sufficient Reason (PSR), but more specifically, his application of the PSR to God's creative activity. Consider Leibniz's remarks in the *Theodicy* about God's inability to create a sphere in general: "suppose that God had decreed to make a material sphere, with no reason for making it of any particular size. This decree would be useless, it would carry with it that which would prevent its effect" (GP 6, 232 = H 249). Thus, determinateness is a requirement of concrete existence because God requires a way to discriminate between the available options.[39] Otherwise, God will have no sufficient reason to create this rather than that; such an indeterminate decree (or a decree about an indeterminate object) would prevent its own effect, since it would stand in violation of the PSR.

To see how Leibniz connects this to his conception of materiality, consider his rejection of material atoms on the grounds that material atoms are intrinsically indiscernible and thus unsuitable objects of God's creative choice. Writing to Clarke, Leibniz makes his view clear:

This supposition of two indiscernibles, such as two pieces of matter perfectly alike, seems indeed to be possible in abstract terms, but it is not

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39. For a more detailed discussion of the sense in which possible worlds and possible substances must be determinate for Leibniz, see Harmer (2017).

> consistent with the order of things, nor with the divine wisdom by which nothing is admitted without reason. The vulgar fancy of such things because they content themselves with incomplete notions. And this is one of the faults of the atomists. (LC 40)

Thus, even though it might seem plausible to suggest that a material atom is *determinate*, this is not the case on Leibniz's understanding of determinate as *fully specified*. As he says immediately following the quoted passage: "I do not admit in matter parts perfectly solid, or that are the same throughout without any variety or particular motion in their parts, as the pretended atoms are imagined to be" (LC 40). The atom lacks internal structure; within its boundaries it is effectively an undifferentiated continuous mass. Therefore, material atoms both induce the problems of the composition of the continuum noted above and (considered as an object of a divine decree) block their own realization for reasons connected to the PSR.

One loose end along these lines is that more recent types of monism, such as the version developed by Horgan and Potrč (2008), assert that although the entire physical world is prior to its regions, these regions display "local variation", which is to say that regions of the physical world are qualitatively heterogeneous even though this heterogeneity is not a result of some underlying mereological structure. On this view, then, regions are not parts (and do not have parts) but they are not undifferentiated mass either.[40] Does Leibniz's view have anything to say about this?

Of course, Leibniz is not engaged with a view exactly like Horgan and Potrč's. However, the version of Material Monism suggested by De Volder (and outlined above) is sufficiently similar that some remarks are in order. Recall that according to De Volder, the entire physical world is a single substance with *modally distinct* regions, that is, regions that vary in, and are thus demarcated by, only qualitative features. Though I cannot engage this question comprehensively here, one way Leibniz could respond to such a view would be to argue that qualitative variation belies internal mereological structure because the observable qualities of bodies always result from configurations of something more fundamental, for example, motions of the parts. This is a basic tenet of the so-called "mechanical philosophy", and one which Leibniz also adopts. In the *Specimen of Dynamics*, Leibniz makes this point in terms of his notion of "derivative force":

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40. For other views that assert the possibility of qualitative heterogeneity without mereological structure, see McDaniel (2006) and Cornell (2016). Thanks to an anonymous referee from this journal for encouraging me to consider questions along these lines.

by derivative force, namely, that by which bodies actually act on one another or are acted upon by one another, I understand, in this context, only that which is connected to motion (local motion, of course), and which, in turn tends further to produce local motion. For we acknowledge that all other material phenomena can be explained by local motion. (GM 6, 237 = AG 120)

Leibniz can, therefore, respond to views like Horgan and Potrč's by giving just such a mechanical analysis of observable qualities.

However, there is one complication to consider. Even De Volder acknowledges that material parts have differential motions and that it is these motions that explain the observable qualities of matter. Still, De Volder denies that the material world has parts, strictly speaking: matter may have modally distinct regions with differential motions, but these are not independent parts. To address this point, Leibniz needs to leave the mechanical philosophy behind, or, at least, he needs to be clear about its limitations. For Leibniz, the motion of material parts requires the existence of active substances underlying matter. Matter alone is not sufficient to explain of force (e.g., motion, but also resistance to motion) in bodies. Writing to Johann Bernoulli in 1698, Leibniz makes this point clearly:

I have often said . . . that all phenomena in bodies, even the force of elasticity, can be explained mechanically. But the principles of mechanism or of the laws of motion cannot be derived from the consideration of extension and impenetrability alone; and so there must be something else in bodies from whose modification conatus and impetus arise, as shapes arise from the modification of extension. (Lo 9 = AG 167)

Thus, motion requires something more fundamental "in" bodies that gives rise to it.[41] This edges up against another major line of argument that Leibniz develops against merely material substance, namely what might be called the Argument from Force.[42] It makes sense, I think, that to combat a picture of the material world so at odds with his own, Leibniz would need to bring a variety of resources to bear, resources at the center of his philosophical system. The interplay between Leibniz's Argument from Unity, which has been the focus of

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41. It is important to note that the relation between monads and bodies is not a mereological one, since monads or "substantial unities are not parts, but the foundations of phenomena" (Lo 303). Still, the notion of "foundation" employed by Leibniz here suggests a picture in opposition to the type of monism I am considering.

42. The Argument from Force is roughly the idea that matter cannot be a substance because it is merely passive and thus cannot explain the presence of forces in bodies. See, for example, "On the Nature of Body and the Laws of Motion" (A 6.4, 1976–1980 = AG 245–250). For discussion of this line of argument, see, for example, Garber (2009: Chs. 3–4).

my discussion above, and his Argument from Force certainly warrants further explanation, but I will leave further discussion of this interplay aside for now.

It remains to consider whether the Determinateness Thesis stands in tension with any of Leibniz's other metaphysical commitments. Though the centrality of the Determinateness Thesis to Leibniz's metaphysics makes this unlikely, there is at least one case that warrants attention, since it concerns certain features of the material world. Leibniz clearly asserts that bodies do not have precise shapes. Sometimes the way Leibniz expresses this view makes it seem as though the shapes of bodies are somehow indeterminate, or as Leibniz says "imaginary". Take, for example, the following passage from *Discourse on Metaphysics* §12:

> It is even possible to demonstrate that the notions of size, shape, and motion are not as distinct as is imagined and that they contain something imaginary and relative to our perception, as do (though to a greater extent) color, heat, and other similar qualities, qualities about which one can doubt whether they are truly found in the nature of things outside ourselves. (A 6.4, 1545 = AG 44)

Passages like this one make it sound as though Leibniz thinks that bodies ultimately lack features such as size, shape, and motion. If this is the case, doesn't Leibniz's rejection of precise shapes in bodies entail that there is some indeterminacy in the material world?

On my view, the absence of precise shapes in bodies is ultimately consistent with the Determinateness Thesis. Leibniz's rejection of precise shapes in bodies is best understood not as the claim that bodies have *indeterminate shapes*, but instead as the claim that bodies have *no shapes whatsoever*. To see this, some subtlety is required concerning the explication of Leibniz's claim that bodies lack precise shapes.

First, the fact that bodies lack precise shapes is, according to Leibniz, a consequence of the actually infinite division of matter. Consider the following passage from *A Specimen of Discoveries of the Admirable Secrets of Nature in General* from around 1688:

> Indeed, even though this may seem paradoxical, it must be realized that the notion of extension is not as transparent as is commonly believed. For from the fact that no body is so very small that it is not actually divided into parts excited by different motions, it follows that no determinate shape can be assigned to any body, nor is a precisely straight line, or circle, or any other assignable shape of any body, found in the nature of things, although certain rules are observed by nature even in its deviation from an infinite series. Thus shape involves something imaginary,

and no other sword can sever the knots that we tie for ourselves by misunderstanding of the composition of the continuum. (A 6.4, 1622 = Ar 315)

In this passage, Leibniz explicitly concludes that bodies lack precise shapes *because* of the actually infinite division of matter. Thus, the lack of shapes in bodies is a consequence of the fact that bodies are divided to infinity.

Second, on Leibniz's account, we attribute precise shapes to bodies in virtue of our less-than-perfect senses in concert with our imagination. Importantly, Leibniz is explicit that, in fact, indeterminacy would arise if bodies were conceived as having precise, that is, geometrical, shapes. The failure of bodies to have such shapes is, by contrast, clearly connected to the fact that bodies are divided to infinity:

> It is the imperfection and fault of our senses that makes us conceive of physical things as Mathematical Beings, in which there is indeterminacy. It can be demonstrated that there is no line or shape in nature that gives exactly and keeps uniformly for the least space and time the properties of a straight or circular line, or of any other line whose definition a finite mind can comprehend. (GP 7, 563; trans. Levey 2005: 16)

Far from being a basis for attributing indeterminacy to bodies, then, the lack of precise shapes is both consistent with, and ultimately follows from the fact that bodies are actually infinitely divided.[43]

Finally, in Leibniz's considered analysis, the difference between precise, geometrical shapes and the infinitely divided and determinate structure of actually existing bodies is, as he puts it, "less than any given amount that can be specified", that is, it is an unassignable difference. As Leibniz writes to De Volder,

> However, the science of continua, that is, the science of possible things, contains eternal truths, truths which are never violated by actual

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43. For a detailed development of this orientation towards Leibniz's rejection of precise shapes in the physical world, see Levey (2005). As Levey concludes, "[i]n the manifest image of nature, bodies appear to us to be moving absolutely and to be finitely complex geometrical objects; neither of those appearances can be absolutely true of the world outside us, as can be demonstrated by an analysis of the paradoxes of the composition of the continuum and by the argument from the equivalence of hypotheses. Yet behind the manifest image is a corporeal world constituted by forces that yield infinitely complex fractal bodies and determine those bodies to be in absolute states of rest and motion. This world is too finely grained and too rapidly changing for a finite mind's perception of it be sustained in consciousness, and so the imagination rounds out a partial representation of the world and thereby furnishes us with a sensory experience that leaves most of the details of corporeal reality obscure" (2005: 26–27).

phenomena, since the difference is always less than any given amount that can be specified. (Lo 333 = AG 186)

Here again, the fact that the difference between the "actual phenomena", that is, bodies, and true continua, that is, geometrical shapes, is less than any assignable quantity is based on the fact that the division of bodies is actually infinite.

Putting all of this together, the best way to understand Leibniz's rejection of precise shapes in bodies is to say that, strictly speaking, bodies have *no shape whatsoever*. The attribution of any candidate shape to a particular body is precluded by the fact that the body is actually infinitely divided and, therefore, its boundary is not uniform across any extent. This understanding of Leibniz's rejection of precise shapes aligns with the discreteness of matter because discreteness goes all the way down, so to speak. The fact that each part of matter is divided to infinity means that any putative boundary of a body is not a smooth boundary, but is broken down into smaller and smaller boundaries of smaller and smaller bodies. This is what prompts Levey to claim that ". . . behind the manifest image is a corporeal world constituted by forces that yield infinitely complex fractal bodies" (2005: 26). I am sympathetic with Levey's view that bodies have infinitely complex shapes, so long as this is understood to mean, given Leibniz's views about the infinite, that they have *no shape whatever*, strictly speaking.[44]

To sum up, then, I believe that even if Leibniz's commitment to the Determinateness Thesis has not been fully vindicated, I have adequately articulated its character and motivation within Leibniz's metaphysics, both as it relates to his analysis of materiality and more broadly. I have also ruled out potential concerns about its alignment with certain features of Leibniz's considered analysis of bodies, in particular his claim that bodies do not have precise shapes. In the end, the Determinateness Thesis is a central commitment of Leibniz's metaphysical project. Thus, it is not altogether surprising to find it playing an important role in the background of Leibniz's Argument from Unity, which is one of Leibniz's major lines of argument against the Cartesian conception of extended substance.

5. Conclusion

Leibniz's view that matter is discrete is a view about the character of material things and their parts. According to the characterization given, material things are, strictly speaking, pluralities, that is, collections of pre-existing parts.

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44. See also Footnote 18 above.

Without this characterization, Leibniz's commitment to the Plurality Thesis would be a weak point in his familiar Argument from Unity against material substances.

As I noted above, it was fairly common in the 17th & 18th century to claim that material things have actual parts.[45] Leibniz shares this commitment. In Leibniz's hands, this commitment amounts to the claim that material parts are independent with respect to motion, and that they enjoy a relative priority to wholes they compose. However, what material things ultimately depend on, for Leibniz—what is absolutely fundamental—are not material parts at all, but non-material substances. These substances provide the ultimate foundation for the existence of the material world.

These commitments are connected: the discreteness of matter supports a key premise—the Plurality Thesis—in Leibniz's Argument from Unity, which is a central argument in the development of Leibniz's monadological metaphysics. The parts of matter, although actual, are also vanishing; the very boundaries that serve to distinguish material parts are themselves vanishing. Thus, discrete matter itself calls out for a foundation in non-material substances. This thought is at the center of Leibniz's rejection of the substantiality of material objects. But it only comes to the fore through an examination of Leibniz's commitment to the discreteness of matter. Since material objects are discrete all the way down, they are inherently pluralities, and therefore, they cannot be ontologically fundamental. The infinitely descending structure of matter points towards the further conclusion that Leibniz wants to draw from the line of thought detailed above: if matter is to exist at all, discrete matter in particular, it requires a foundation in something non-material. Therefore, Leibniz's commitment to discreteness drives his argument (or, at least, one of his arguments) for non-material substances: first substantial forms and, ultimately, monads.

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45. For a detailed discussion of the so-called "actual parts doctrine" among the early moderns, see Holden (2004: Ch. 2). For discussion of the way Leibniz's views about material parts relate to the actual parts doctrine, see Harmer (2020).

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