More information about this series at http://www.springer.com/series/6608

Ohad Nachtomy • Reed Winegar
Editors

Infinity in Early Modern Philosophy

References

Ariew, R. (1987). The infinite in Descartes' conversation with Burman. *Archiv für Geschichte der Philosophie, 69*(2), 140–163.

Augustine (1991). *Confessions* (C. Henry, Trans.). Oxford: Oxford University Press.

Beyssade, J. M. (1979). *La philosophie première de Descartes*. Paris: Flammarion.

Beyssade, J. M. (1992). The idea of God and the proofs of his existence. In J. Cottingham (Ed.), *The Cambridge companion to Descartes* (pp. 174–199). Cambridge: Cambridge University Press.

Boehm, O. (2014). Freedom and the Cogito. *British Journal for the History of Philosophy, 22*(4), 704–724.

Conway, A. (1992). In M. Nicolson & S. Hutton (Eds.), *The Conway letters: The correspondence of Anne, Viscountess Conway, Henry more, and their friends* (pp. 1642–1684). Oxford: Oxford University Press.

Curley, E. (1978). *Descartes against the skeptics*. Cambridge: Harvard University Press.

Janiak, A. (2015). Mathematics and infinity in Descartes and Newton. In V. De Risi (Ed.), *Mathematizing space* (pp. 209–230). Basel: Birkhäuser.

Kendrick, N. (1998). Uniqueness in Descartes' 'infinite' and 'indefinite'. *History of Philosophy Quarterly, 15*(1), 23–36.

Koyré, A. (1957). *From the closed world to the infinite Universe*. Baltimore: Johns Hopkins University Press.

Leibniz, G. W. (1969). In L. E. Loemker (Ed.), *Philosophical papers and letters*. Dordrecht: Reidel.

Mancosu, P. (1996). *Philosophy of mathematics and mathematical practice in the seventeenth century*. New York: Oxford University Press.

McGuire, J. E. (1983). Space, geometrical extension, and infinity: Newton and Descartes on extension. In W. R. Shea (Ed.), *Nature mathematized* (pp. 69–112). Reidel: Dordrecht.

Naaman-Zauderer, N. (2010). *Descartes' deontological turn*. Cambridge: Cambridge University Press.

Nolan, L., & Nelson, A. (2006). Proofs for the existence of God. In S. Gaukroger (Ed.), *The blackwell guide to Descartes' meditations* (pp. 104–121). Oxford: Blackwell.

North, J. (1983). Finite and otherwise. Aristotle and some seventeenth century views. In W. R. Shea (Ed.), *Nature mathematized* (pp. 113–148). Reidel: Dordrecht.

Schechtman, A. (2014). Descartes's argument for the existence of the idea of an infinite being. *Journal of the History of Philosophy, 52*(3), 487–517.

Schechtman, A. (2016). Substance and independence in Descartes. *Philosophical Review, 125*(2), 155–204.

Schechtman, A. (forthcoming). Three infinities in early modern philosophy. *Mind*.

Spinoza, B. 1985. *The collected works of Spinoza*. Vol. 1 (Edwin Curley, Ed. and Trans.). Princeton: Princeton University Press

Vilmer, J. B. J. (2008). La veritable nature de l'indéfini cartésien. *Revue de Métaphysique et de Morale, 60*, 503–515.

Vilmer, J. B. J. (2011). L'indéfini cartésien entre politique et langage. *Revue philosophique de Louvain, 109*(3), 443–460.

Wilson, M. (1999). Can I be the cause of my idea of the world? (Descartes on the infinite and the indefinite). In M. Wilson (Ed.), *Ideas and mechanism: Essays in early modern philosophy* (pp. 108–125). Princeton: Princeton University Press.

Chapter 4
Descartes on the Infinity of Space vs. Time

Geoffrey Gorham

Abstract In two rarely discussed passages – from unpublished notes on the *Principles of Philosophy* and a 1647 letter to Chanut – Descartes argues that the question of the infinite (or indefinite) extension of space is importantly different from the infinity of time. In both passages, he is anxious to block the application of his well-known argument for the indefinite extension of space to time, in order to avoid the theologically problematic implication that the world has no beginning. Descartes concedes that we always imagine an earlier time in which God might have created the world if he had wanted, but insists that this imaginary earlier existence of the world is not connected to its actual duration in the way that the indefinite extension of space is connected to the actual extension of the world. This paper considers whether Descartes's metaphysics can sustain this asymmetrical attitude towards infinite space vs. time. I first consider Descartes's relation to the 'imaginary' space/time tradition that extended from the late scholastics through Gassendi and More. I next examine carefully Descartes's main argument for the indefinite extension of space and explain why it does not apply to time. Most crucially, since duration is merely conceptually distinct from enduring substance, the end or beginning of the world entails the end or beginning of real (as opposed to imaginary or abstract) time. In contrast, extension does not depend on any enduring substance besides itself.

4.1 Introduction

Although one prominent commentator has declared that the infinite plays so important a part in the philosophy of Descartes that "Cartesianism may be considered as being wholly based on that idea" Koyré (1957, 106), Descartes himself warns us that "we should never enter into arguments about the infinite" (AT 8A 14; CSM 1

G. Gorham (✉)
Philosophy Department, Macalester College, Saint Paul, MN, USA
e-mail: ggorham@macalester.edu

O. Nachtomy, R. Winegar (eds.), *Infinity in Early Modern Philosophy*,
The New Synthese Historical Library 76,
https://doi.org/10.1007/978-3-319-94556-9_4

201). Descartes hoped to forestall "tiresome arguments" about the infinite by substituting the more modest, anthropocentric notion of the indefinite: "in the case of anything in which, from some point of view, we are unable to discover a limit, we shall avoid asserting that it is infinite and instead regard it as indefinite" (AT 8A 15; CSM 1 202). But although familiar conceptual paradoxes about the infinite – such as whether the infinite is odd or even – are perhaps sidestepped in this way, long-standing cosmological problems about the extent and duration of the world are merely re-formulated: from our point of view, can we discern whether the world has limits in space and time?

Descartes maintains that the world is spatially indefinite but temporally limited. He therefore departs from the standard seventeenth-century method of treating space and time as analogous, with conclusions about the structure of space typically extended, with minimal adjustments, to time.[1] For Descartes, the indefinite extension of space (and hence body) was a conceptual necessity (notwithstanding the incomprehensible power of God). In the *Principles of Philosophy* (II, 21) he insists that wherever we imagine boundaries to extension we are forced to recognize that there must be indefinitely extended space beyond them "which we not only imagine but also perceive to be truly imaginable, that is, real" (AT 8A 52; CSM 1 232). Similarly, he explains to Henry More: "I think it involves a contradiction that the world should be finite; because I cannot but conceive a space beyond any bounds you assign to the universe; and on my view such a space is a genuine body" (AT 5 345: CSMK 375). Put simply, Descartes's argument is that we find it inconceivable that extension (hence body; hence the world) has limits.

It might seem that we find it just as difficult to conceive temporal limits on the world. That is, we find it hard to conceive how a motion, a body, or the world as a whole, could begin (or end) without being preceded (or followed) by time. If so, it should follow for Descartes that duration is indefinite in both temporal directions just as extension is indefinite in all spatial directions. However, although he does not raise this issue in either published versions of the *Principles*, it evidently occurred to Descartes that his reasoning about indefinite extension in *Principles II*, 21, mentioned above, would seem to make extension and duration equally indefinite. For in his own annotations to the *Principles* he notes, and attempts to allay, the "fear that in philosophizing about the indefinite extension of the World we should find its duration likewise mounting to infinity" (AT 11 656).[2] He observes, for one thing, that faith precludes an eternal world (at least looking backwards). Thus, in the annotation Descartes references his own admonition at the end of Part One of the *Principles*, that "divine authority must be put before our own perception" (8A 39; CSM 1 221). But he also declares it certain that our "natural reason" (*ratione naturali*) cannot decide for us the question of the world's beginning. Unfortunately,

[1] See further Gorham (2012).

[2] The annotations were found among papers owned by Leibniz, who titled them 'Annotations which Descartes seems to have made on his *Principles of Philosophy*' (AT 11 545). The date is unknown, though obviously between 1644 and 1650. On their origin and authenticity, see AT 10 207-210; AT 11 647a and 654a. Judging by the surrounding notes, it is plausible that Descartes is here commenting on *Principles* II, 21.

his annotation leaves the matter there, deferring to faith. I think it is worth inquiring why Cartesian natural reason – which is so confident about the indefinite extension of the world – is incapable of discerning its duration (whether indefinite or not). The answer I will offer depends on a fundamental ontological asymmetry between Cartesian space and duration.

4.2 Letter to Chanut I: Space

Fortunately, Descartes takes up the issue in more detail in a 1647 letter to Chanut, who had passed on Queen Christina's concerns that Descartes might be among those who hold the world to be infinite, and that such a doctrine was injurious to the Christian religion (May 11, 1647; AT 5 21). In response, Descartes first puts himself in the good company of the "Cardinal [Nicholas] of Cusa," who "supposed the world to be infinite without ever being censured by the Church" (June 6, 1647; AT 5 51; CSMK 319). And he points out that we honor God to the extent we represent his works as great. He goes on to emphasize, as in the *Principles* and annotations, that he maintains only that the world is *indefinite* rather than *infinite*. In the *Principles* themselves (I, 26-7) he explains that the term 'infinite' should be reserved for God, the sole being we understand positively to have no limits. We should say a being is indefinite when we know only negatively that "we are unable to discover a limit" (AT 8A 15; CSM 1 202. See also AT 5 356; CSMK 377).

This account seems to conflate several distinct senses in which we might be unable to discover a limit:

(i) any limit we discover could conceivably be greater.
(ii) we cannot discover any limit.
(iii) we cannot conceive (or find contradictory) any limit.[3]

Consider the examples of undiscoverable limits Descartes gives in the *Principles*: the number of stars; the divisibility of quantity; the extension of the universe. The number of stars seems to be indefinite in the weakest sense above (i). He says that however many stars we imagine there to be, "God could have created more" (ibid.). But this seems too weak a sense of indefinite for Descartes's conception of space, since it would include even things with limits we might actually determine, such as the number of humans or the size of the earth. (In fact, Descartes drops the 'number of stars' example from all subsequent discussions of the indefinite.) The stars might also qualify under (ii) since it may be that they are too numerous or remote for

[3] Wilson notices this "haziness" in the characterization of indefiniteness but offers a slightly different taxonomy: (i) we notice no limit; (ii) we cannot conceive a limit; (iii) a limit is repugnant or contradictory (1999, 113). I am unsure about her distinction between (ii) and (iii) since Descartes says to More: "It conflicts with my conceptions or, what is the same, involves a contradiction that the world should be finite or bounded; because I cannot but conceive a space beyond whatever bounds you assign to the universe" (AT 5 345; CSMK 374-5). For recent, illuminating discussions of the infinite/indefinite distinction in Descartes see Ariew (1987), Kendrick (1998) and Schectman (this volume).

beings like us to gauge even though we can easily conceive that there is a definite limit. (I'll later suggest that the duration of the universe is indefinite in at most the senses of (i) or (ii).) The divisibility of the quantity and extent of the universe seem to be indefinite in the strongest sense of (iii) and it is this sense that is most important to Descartes. Thus when it comes to his specific arguments about indefinite divisibility and extent later in the *Principles*, he emphasizes that we are unable to conceive a genuine limit to the division and extent of matter.[4]

(iii) is also the crucial sense of 'indefinite' in all the passages that address indefinite spatial vs. temporal extent. Thus, returning to Descartes's response to Queen Christina, he admits that although we lack a positive reason to know the world is infinite, can we neither prove nor even conceive that it is finite. For "if we suppose the world to be finite we are imagining that beyond its boundaries there are some spaces which have three dimensions of their own and so are not purely imaginary, as the philosophers label them" (AT 5 52; CSMK 319). He once again reassures the Queen (via Chanut) that he does not assert that the world is absolutely infinite since God may know it to be limited for reasons incomprehensible to us; nevertheless, since he finds himself unable to conceive that the world has bounds he concludes that the world is indefinite. Descartes then turns to the question whether the same logic proves the duration of the world to be indefinite (in the future and past). Before examining his treatment of this question, it will prove worthwhile to digress briefly on the historical context of Descartes's analysis.

4.3 Digression: Imaginary Space

In an important, late defense of the indefinite extension of the world, Descartes explicitly contrasts his own view with those "who call this space imaginary and thus regard the world as finite" (AT 5 345; CSMK 375). In both this letter to Henry More, and in the letter to Chanut, Descartes is adverting to a long tradition within late scholasticism analyzing the ontological status of the space we 'imagine' beyond the limits of our finite world.[5] The metaphysics of Suárez, for example, which was known to Descartes,[6] admits an 'imaginary space' beyond the finite realm of the cosmos in order to conceive the place of the outermost sphere, the power of God to translate the entire world, and so on. And imaginary time or succession is likewise permitted for parallel reasons. However, Suárez is at pains to emphasize that imaginary space and time are mere conceptual tools or 'beings of reason' in contrast with the real space and time of bodies and motion: "We conceive of this imaginary space as having dimensions. But so conceived this space is a mere being of reason, a

[4] AT 3 477; CSMK 3 202; AT 5 273; CSMK 363.

[5] The definitive treatments of this tradition are Duhem (1987) and Grant (1981). Des Chene (1996) also provides an insightful discussion, giving particular attention to Descartes. On imaginary time, especially in Suárez, see Daniel (1981) and Bexley (2012).

[6] AT 7 235; CSM 2 164

negation or privation . . . this is also true in the example of imaginary succession, which we conceive apart from real time" (DM 54, IV, 7). Among non-Aristotelian contemporaries of Descartes, Gassendi also relied on the imaginary space/time tradition in defense of an infinite universe: "by the words 'space' and 'spatial dimensions' we do not mean anything but that space which is commonly called 'imaginary' and which the majority of sacred doctors admit exists beyond the world" (Brush 389). Gassendi is more guarded than Descartes about the ontology of space, emphasizing with the scholastics that it is *nihil positivam* since it falls outside the substance/accident dichotomy. Nevertheless, he insists that "space and time must be considered real things, or actual entities, for although they are not the same sort of thing as substance and accident they still exist and do not depend on the mind" (Brush 384-5). Both extramundane space and premundane time are real: "the universe could have been created a thousand years before the creation . . . because time then flowed, of which the revolutions of the sun such as we now have could have been an adequate measure" (Brush 397).[7] So although Suárez and Gassendi draw different conclusions about the ontological status of space and time, they both assume that what goes for the one, goes for the other.

4.4 Letter to Chanut II: Time

Returning to Descartes we find, in contrast, that he resists the implication that imaginary time is as real and indefinite as imaginary space. In the letter to Chanut, after rehearsing his argument for the indefinite extension of the world, he turns to the worry (not raised by Christina) that this proves too much, namely that the world also has no beginning or end in time. Descartes remarks that comparing the extension of the world with its duration in this respect merely occasions the thought "that there is no imaginable time before the creation of the world, in which God could not have created it if he had so willed" (AT 5 52; CSMK 320). His point does not seem to be that we cannot imagine time before creation, since we clearly can, but simply that God could have created the world at any such imagined earlier time. Of course, there is likewise no imaginable space beyond the boundaries of a putatively finite world in which God could not have created matter. The difference is that natural reason alone tells us that God really did create extension/matter in the indefinite space we imagine; but in the case of time Descartes insists that the always earlier imaginable duration of the world does not entail that God "really did create it an indefinitely long time ago" (AT 5 53; CSMK 320). He argues as follows:

> For the actual or real existence of the world during the last five or six thousand years is not connected to the possible or imaginary existence which it might have had before then in the way the actual spaces one conceives surrounding a globe (i.e. the world as supposed infinite) are connected with the actual existence of the same globe (ibid.).

The alleged dis-analogy in the 'connections' between imaginary and actual spaces vs. imaginary and actual duration is not immediately evident. Perhaps

[7] See LoLordo (1997).

Descartes's point is simply that, given the conceptual interdependence of space and body, imaginary space entails actual body; but there is no parallel interdependence between time and body. But this would not show that we can conceive a beginning or end to time itself, on Descartes's terms. For his proof of the indefinite extension of the world would still imply the indefinite extension of mere space even if he conceded the possibility of a finite world surrounded by an extramundane vacuum. This is most evident in the *Principles* version of the proof, which proceeds in two steps. He first maintains that the space we inevitably imagine beyond any putative limits to the world is not something we "merely imagine" but something "imaginable in a true fashion, i.e. real (*vere imaginabilia, hoc est realia esse*)" (AT 8A 52; CSM 1 232). The next step is that "it follows that these spaces contain corporeal substance which is indefinitely extended" (Ibid.). This follows from the reality of the space beyond limits, he points out, given the identity of space and body established a few sections earlier (II, 11). So even someone who rejected this second step, and insisted on a real distinction between extension and body, would have to admit an indefinite extramundane void based on the first step. Descartes himself makes this point in response to More, who invoked the famous Archytas thought experiment (AT 5 312) of extending a sword at the edge of a supposedly finite world: "When you imagine a sword going through the limits of the universe, you show that you too do not conceive the world as finite. . . though you give the name 'vacuum' to what you conceive" (AT 5 345; CSMK 375). Similarly, the fact that we imagine always earlier (later) times would entail an indefinite past (future), according to Descartes's argument, even if that past (future) is empty rather than full of matter and motion.

4.5 Cartesian Duration and Time

But perhaps this is enough for Descartes's purposes: he can allow indefinite empty time before the creation of the world so long as the religiously problematic indefinite pre-existence of *the world* is blocked. The problem is that Descartes's metaphysical principles seem to preclude empty time no less than empty space. To see why, we need to examine briefly his metaphysics of time.[8] Contrary to the long Aristotelian tradition that made time 'the number of motion', Descartes insists that "the duration which we find to be involved in movement is certainly no different from the duration involved in things which do not move" (AT 8A 27; CSM 1 212). It is true that in order to measure this duration common to all things, "we compare their duration with the greatest and most regular motions, which give rise to years and days, and call this duration 'time'" (Ibid.). But Descartes insists that we must not conflate duration itself, which is intrinsic to all things, with its temporal measure, which is an intellectual abstraction: "when time (*tempus*) is distinguished from duration taken in the general sense (*durationе generaliter*) and called the measure of movement (*numerum motum*), it is simply a mode of thought" (Ibid.).

[8] For a more detailed discussion, see Gorham (2007).

But what is duration itself? Several sections earlier in the *Principles*, Descartes lists duration (along with substance, order and number) among the most general categories which "extend to all classes of things" whether thinking or extended (AT 8A 23; CSM 1 208). A little later he says we can have a distinct understanding of these universal or transcendental categories only if we do not assign to them the status of substance. Thus, rather than being anything separate from the thing which endures "we should regard the duration of a thing as simply a mode under which we conceive the thing insofar as it continues to exist" (AT 8A 26; CSM 1 211). His point here is not that duration is a mere mental abstraction, or mode of thought, like time. For he goes on to classify duration as an unchanging attribute: "that which always remains unmodified – for example existence or duration in the thing which exists or endures – should be called not a quality or mode but an attribute" (AT 8A 26; CSM 1 211-2). As such, duration and existence are not mere modes of thought but rather ways in which anything can be conceived. Indeed, he observes that "since a substance cannot cease to endure without also ceasing to be, the distinction between a substance and its duration is merely a conceptual one" (AT 8A 39; CSM 1 214). In the French edition of the *Principles*, he observes that all such attributes "allow us to have different thoughts about a single thing" (AT 9B 53).

We can now see why Descartes can allow neither time nor duration before/after creation: not time, because it is a mere mode of thought, and not duration, because it cannot be really separated from the continuance in existence of things. He makes this explicit in the correspondence with More. More suggested: "If God annihilated the universe and created another one out of nothing much later, this 'between-world' or 'world-absence' would have its own duration whose measure would be days, years and centuries. There is therefore a duration of something that does not exist" (AT 5 302). Descartes's reply is blunt: "it involves a contradiction to conceive of any duration intervening between the destruction of an earlier world and the creation of a new one" (AT 5 343; CSMK 373). This response confirms my point that Descartes cannot avoid a world indefinitely extended in time, any more than a world indefinitely extended in space, by separating time or duration from the world.

His dismissal of 'between-world' duration also reveals how similar Descartes's reasons for rejecting empty time are to his reasons for rejecting empty space. Extension and duration are both attributes, the latter general or transcendental and the former peculiar to bodies. But we have already noted that attributes are merely conceptually distinct from their substances. So to conceive an extension distinct from corporeal substance is to conceive an extended nothing. Thus, Descartes rejects extension without body because "it is a complete contradiction that a particular extension should belong to nothing" (AT 8A 49; CSM 1 230).[9] We can now see that he rejects More's speculation about a duration of "something that does not exist" as contradictory for the same reason. It invites us to conceive duration apart from any continuation in existence. But for time to pass between worlds, with nothing intervening, is no less contradictory than for the sides of a vessel to remain apart though nothing is between them.

[9] See also AT 8A 50; CSM 1 231; AT 5 223; CSMK 358.

4.6 Creation from Eternity

So Descartes cannot allow duration to extend indefinitely backward without admitting an eternal world, anymore than he can allow space to extend indefinitely beyond a limited material cosmos. Apart from falling back on faith, one way out of the problem would be to demonstrate from natural reason that the world could not have existed from eternity. But on this famous question, Descartes seems to adopt a quite liberal position. In conversation with Burman, for example, he reportedly declares: "I do not see why God should not have been able to create something from eternity" (AT 5 155; CB 15). The topic at this point in the conversation is the second of the Third Meditation's proofs of God's existence, which establishes that I would need to be continuously created by God even if "I have always existed as I do now" (AT 7 78; CSM 2 33). Indeed Descartes seems committed to eternal creation by his well-known doctrine of the divine origin of the eternal truths: "from all eternity he willed and understood them to be" (AT 1 152; CSMK 25). Descartes also makes clear that an infinite or indefinite past is not absurd or contradictory in itself. When Burman pushes him on the suggestion that God might have created the world from eternity – "but then there would have been an infinite number" (AT 5 155; CB 16) – Descartes denies there is any absurdity in this. He points out that there is no less an infinite division within any given finite quantity. Indeed, Descartes seems to think the latter sort of infinite division within matter is *required* under certain physical conditions (AT 8A 59-60; CSM 1, 239).[10] He observes furthermore that we believe, as a matter of faith, that there is an infinite number with respect to the future, "so why shouldn't it be the same with respect to the past?" (AT 5 155; CB 16).

4.7 The Mereological Independence Doctrine

So far, the asymmetry remains unexplained: Descartes should say – faith notwithstanding – that the world is indefinite in extension *and* duration. But let us return once again to the detailed letter to Chanut and consider more carefully Descartes's insistence that the possible earlier existence of the world is not "necessarily connected (*necessairement jointe*)" to its actual later existence in the strong way that real extension is implicated beyond any imaginable boundary of the world. The disanalogy in these connections does not seem to arise from differences in our conceptions. For Descartes acknowledges that we find it difficult to conceive a temporal beginning, though his expression is somewhat tortured: "*il n'y a point de temps imaginable avant la creation du monde quel Dieu n'eust pu le creer, s'il eust voulu*" (AT 5 53; CSMK 320). He does not explicitly say that we positively imagine earlier times, only that there is no imaginable time unavailable for earlier creation. But his argument doesn't seem to turn on such cautious phrasing. For he goes on to say

[10] See also AT 4 113; CSMK 232; AT 5 274; CSMK 364; AT 7 113; CSM 2 81.

explicitly that the world's "possible or imaginary existence" earlier does not entail its actual indefinite existence. So we do positively imagine earlier times, just like space beyond the world; but for some reason only the latter carries ontological import.

Descartes does not reveal the reason until the very terse conclusion of his argument. After asserting the crucial dis-analogy in the 'connections' between actual and imagined space vs. time, he turns to a seemingly different issue: the eternal future duration of the world (which faith teaches). He says the indefinite future provides a more solid reason to infer its indefinite past duration than does its indefinite extension. But the former is not a solid reason at all: "no one infers" eternal creation in the past from the promise of eternal life (AT 5 53; CSMK 320). The relevance of this apparent red herring to the crucial dis-analogy with extension is made clear only in the final clause of the paragraph, where he states that we cannot infer the eternity of the world "because every moment of its duration is independent of every other" (Ibid.).This, of course, is the much-discussed premise of the second Third Meditation proof of God's existence. In that proof, it is first restricted to the meditator's own duration: "a lifespan can be divided into countless parts each completely independent of the other" (AT 7 49: CSM 2 48). But Descartes later extends it to bodies as well: "The separate divisions of time do not depend on one another. Hence the fact that the body in question is supposed to have existed up until now 'from itself,' that is, without a cause, is not sufficient to make it continue to exist in the future" (AT 7 110; CSM 2 110).[11] From this he derives his version of the doctrine of continuous creation – the entire universe must be "recreated" by God at each instant so that "the distinction between preservation and creation is only a conceptual one (AT 7 49; CSMK 33) – which not only requires God's existence but also grounds the laws of nature in the *Principles of Philosophy* (AT 8A 61; CSM 1 240).

Besides these two functions – proving God and the laws of nature – we can now see that Descartes has a third role for the versatile doctrine of the independence of temporal parts: blocking a seemingly Cartesian argument from natural reason for the indefinite duration of the world. Granted that I always may, perhaps irresistibly, imagine an earlier/later time, it does not follow that what I imagine is real. For the temporal parts of any enduring thing are not conceptually connected in such a way that bordering parts of time guarantee one another's existence: "I regard the divisions of time as being separable from each other so that the fact that I exist now does not imply that I shall continue to exist in a little while" (AT 7 109; CSM 2 78-9). While I can imagine that I go on living indefinitely, it is entirely up to God whether this hope is realized. But the situation is different with extension, I would like to suggest. When we consider the plenum abstractly, as geometrical *res extensa*, there is a sense in which its parts are mutually dependent. We can see this if we suppose any part of extension persisting while a part next to it is destroyed. Either a vacuum would then exist, which is impossible on Cartesian principles, or some other part of

[11] Versions of the argument and doctrine are repeated frequently. See AT 6 35, 45; AT 8A,13; AT 7 109, 165, 369–370; AT 5 45, 53, 155; CSM 1 128–129, 133, 200; CSM 2 78–79, 116, 254–255; CSMK 320; CB, 15–16. See Gorham (2004).

extension would 'move in' to fill the impossible gap (AT 5 272-3; CSMK 363). This explains, I believe, why Descartes says in the Synopsis to the *Meditations* that while individual bodies can perish since they are merely a collection of accidents, "body in general (*corpus in genere*) can never perish" (unless God withdraws his concurrence) (AT 7 10; CSM 2 14). This mutual interdependence of parts also explains why extension or body in general is indefinite.[12]

This does not mean that extension, unlike duration, is independent of God.[13] But I think it does mean that if God creates any part of *res extensa* then the entire indefinite plenum is necessitated as well, in one fell swoop. This is suggested in the creation story of *Le Monde*, which again exploits the imaginary space tradition: "a whole new [world] which I shall bring into being before your mind in imaginary spaces" (AT 11 31; CSM 1 90). Pre-existing imaginary space is, as it were, presupposed. While acknowledging that "the philosophers tell us that such spaces are infinite", in order to prevent confusion Descartes asks us to confine our imagination "to a determinate space which is no greater, say, than the distance between the earth and the principal stars in the heavens" (AT 11 32; CSM 1 90). It is clear that he is not supposing that God might create a finite world, for he insists that "the matter which God has created extends indefinitely far in all directions" (Ibid.). And we should think of this indefinite matter as a "real perfectly solid body which uniformly fills the entire length, breadth and depth of this vast space in the midst of which we have brought our mind to rest" (AT 11 33; CSM 1 91). The "idea of this matter is included to such an extent in all the ideas that our imagination can form that you must necessarily conceive it or you never imagine anything at all" (AT 11 35; CSM 1 92). Indefinite space as a whole is thus implied by the idea of any finite extended thing.

A similar point is indicated in a 1640 letter to Regius, who commented on a draft of the *Meditations*. Descartes maintains that I could not have the positive of idea of God's infinite perfections "unless we derived our origin from a being in which they

[12]This, of course, is a version of the argument Spinoza would later champion that extended substance is not really divisible: "Since there can be no vacuum in nature (as I discuss elsewhere) but all their parts must concur so there is no vacuum, it follows that they cannot be really distinguished" (Ethics I P15 Schol (iv); C 96). There are many excellent discussions of Descartes's theory of corporeal substance, such as Slowik (2001).

[13]Descartes frequently asserts that corporeal substance is divisible (AT 3, 477; CSMK, 202–203; AT 8A, 51, CSM 1, 231), even into parts that are really distinct from one another (AT 8A, 29, CSM 1, 213). But the fact that the different parts of matter are really distinct, and hence substances as such, does not imply that each part is an individual *body*. For Descartes, bodies are individuated by relative motion so that "if the division into parts occurs simply in our thoughts there is no resulting change" (AT 8A, 52; CSM 1, 232). Furthermore, and *pace* recent papers by Lennon (2007) and Schmaltz (2009) it is unclear why the real distinction among the parts of extension should threaten either the substantiality of extension itself or the doctrine that the parts of extension are mutually interdependent. On the first issue, there is no good Cartesian reason (I know of) to deny substantiality to something that has really distinct or substantial parts. On the second issue, the parts of extension seem to be mutually interdependent in the way I have described even granted all these parts are really distinct. The question is not whether the parts of extension of duration are really distinct – I think they are in both cases – but whether these parts are mutually interdependent in such a way that if one part exists then necessarily they all do.

are actually infinite" (AT 3 64; CSMK 147). Somewhat surprisingly, he extends this reasoning to our idea of indefinite space: "Similarly I could not conceive of an indefinite quantity by looking at a very small quantity or finite body unless the size of the world was actually or at least possibly indefinite" (Ibid.). My account offers a reason why Descartes is prepared to infer actually infinite space from the idea of finite extension: the parts of space are all so conceptually connected that the idea of any part requires the idea of all other parts, *ad indefinitum*.

The interdependence of the parts of space is also evident in Descartes's rejection of a plurality of worlds in *Principles* II, 22, which immediately follows his demonstration of indefinite extension. He says the matter composing any other world would have to be the same as composes this world, so not really a different world. This seems to leave him open to the pluralist objection that another world might be composed of the same kind of matter yet separate from this one. But he insists that this is impossible since "the matter whose nature consists simply in its being an extended substance already occupies absolutely all the imaginable space in which the alleged additional worlds would have to be located" (AT 8A; CSM 1 232). The suggestion seems to be that any 'other' extended world is conceived as bearing a spatial relation to the 'local' world, and therefore connected or interdependent in the way that the shorelines of two continents and the ocean between them all mutually connect.

So the parts of indefinite extension conceived as mere *res extensa* are mutually dependent because the parts are nothing more than their mutual geometrical relations. If one of two neighboring parts had failed to exist then another would have been in its place; but in that case the interloper would not be a distinct part from the original. And if *duration* were conceived purely abstractly or geometrically, perhaps as a line with a direction and flow, then its parts would be interdependent in a way similar to space. Reaching the 7th day of a week, for example, requires passing through the first 6 days. But, as we have seen, Descartes is at pains to distinguish the concrete duration of things (whether they move or not) from the abstract measure 'time'. The parts of duration, since they are identical to the continued existence of enduring things, are not conceptually interdependent. My brother might endure while I do not, and the world as a whole begins (or ends) when things begin (or cease) to endure. In response to Gassendi, Descartes makes clear that the independence of parts doctrine applies strictly to concrete duration rather than abstract time. Thus, when Gassendi complained against the Third Meditation proof: "Can we think of anything whose parts are more inseparable from one another than your duration?" Descartes responded that such interdependence characterizes at most "time considered in the abstract" but not "the duration of the thing which endures (*durantione rei durarantis*)" (AT 7 369-70; CSM 2 255). This explains why he ignores Gassendi's suggestion that the parts of a thing's duration "are merely external, they flow on without playing any active role" like a river flows past a rock (AT 7 301; CSM 2 209). For Descartes, such a metaphor wrongly takes duration (as opposed to time) to be ontologically separable from enduring things. But unlike the hours of a day conceived as a measure, or extension conceived purely geometrically,

no part of my concrete duration is intrinsically linked to any other. And for this reason we cannot infer from what we imagine about the world beginning earlier that this is "truly imaginable, that is, real" (AT 8A 52; CSM 1 232).[14]

4.8 Temporal Infinitists

To summarize, Cartesian extension conceived purely abstractly or geometrically, independently of this or that fleeting body, must be indefinite (at least relative to our conception). In contrast, Cartesian duration is intrinsic to enduring minds and bodies and no part of this duration carries any guarantee of continuance or antecedence, however much we might imagine (or hope) it did. And this is the sense in which "natural reason" aids faith in proscribing a world without a temporal beginning or end (AT 11 656). It is worth noting that those among Descartes's contemporaries who privilege abstract time over concrete duration – that is, who think time is prior to and independent of the persistence of created things – tend to regard time as necessarily infinite; and they do so for reasons that parallel Descartes's reasons for denying infinity to concrete duration. For example, Gassendi insists that "time considered in itself has neither beginning nor end" (Brush 395). Gassendi is somewhat unclear why time in itself "cannot be stilled by any force", but he is fond of the analogy between space as mere extension in length, width and depth and time as a "flowing extension in which it is possible to designate past, present and future" (Brush 391). As we have seen, it is precisely this reification of time, conceived geometrically, that Descartes rejects.

Newton endorses Descartes's basic argument that "we cannot imagine a limit anywhere without imagining space beyond it" (DG 23). So he likewise agrees with the doctrine of *Le Monde* that the concept of indefinite space is presupposed in the idea of any finite object: "if any being whatsoever is posited, space is posited" (DG 25). Unlike Descartes, Newton extends this analysis to duration: "we cannot think that there is no duration even though we might suppose that no thing endures" (DG 26). Like Descartes's abstract time, the parts of Newton's duration depend on their relations to all other parts: "the parts of duration are individuated by their order; if for example yesterday could change places with today, it would lose its identity and become today" (DG 25). We can, of course, easily imagine an end to the duration of this or that enduring thing, as Descartes points out. But it is as hard to conceive an end to a mere ordering apart from anything else – such as the *Principia*'s "absolute, true, and mathematical time, [which] of itself, and from its own nature, flows equably without relation to anything external" (Principia 408) – as to conceive a limit on geometrical space or the series of natural numbers.

[14] I do not here take up the question of the infinite or indefinite divisibility of time. In my view, the same considerations in favor of the indefinite division of space carry over to duration. This is not inconsistent with the independence of parts doctrine since that concerns the relation between successive parts of duration not the proper sub-parts of any temporal interval. The discussion of Cartesian temporal (dis)continuity has a long history. Recent examples: Arthur (1988), Garber (1992), Levy (2005), and Gorham (2008b).

Locke holds that anyone "may easily conceive in his mind the beginning of motion but not at all duration. . . so also he may set limits to body, and the extension belonging to it, but not to space" (Essay II, xiv, 26; 193). But, even more than Gassendi and Newton, Locke recognizes the role mathematical abstraction, particularly number, plays in convincing us of the necessary infinity of space and time: "in space and time, when the mind pursues the idea of infinity it there makes use of the ideas and repetitions of number" (Essay II, xvii, 9; 215). More specifically, we think of the infinite series of natural numbers as "like a line, whereas one end terminating with us, the other is extended still forward beyond all that we can conceive" and "in duration, we consider it as if this line of numbers were extended both ways to an unconceivable, indeterminate and infinite length" (Essay II xvii 10; 215).

Gassendi, Newton and Locke all closely associate infinite space and time with God's immensity and eternity. But Descartes strongly rejects any literal conception of God's immensity: "the alleged extension of God cannot be the subject of the true properties which we perceive very distinctly in all space" (AT 5 271; CSMK 362).[15] But shouldn't the eternal duration of God (along with the eternal truths he decreed) entail that time did not begin? Descartes himself suggests as much to Burman in explaining God's eternity:

> since we can divide it up after the creation of the world why should it not have been possible to do the same before creation since duration remains constant? Thus, eternity has now co-existed with created things for, say, five thousand years, and occupied time; so it could have done the same before creation, if we had had some standard to measure it by. (AT 5 149; CB 7)

However, I believe the passage can be reconciled with the letter to Chanut quite easily. Since God is eternal (i.e. sempiternal), duration is indeed beginningless. But this follows from the nature of God, not from our conceptions of time, whereas the indefinite extension of the universe follows simply from our conception of space. It is perhaps less easy to reconcile the Burman passage with Descartes's dismissal as contradictory More's speculations about a 'between-world' duration (CSMK 373).[16] But recall that Descartes is here responding specifically to More's suggestion that the between-world (*intermundium*) or 'world-absence' (*absentia mundi*) "would have its own duration" (AT 5 302). The contradiction consists in supposing that the 'world-absence' itself would have duration, any more than it would have extension, not in supposing that God would then endure. The point to Chanut remains the same: the universe is by its nature indefinitely extended but its duration depends on the arbitrary will of God.

[15] See also AT 5 275; CSMK 364; AT 5 342; CSMK 372.

[16] Koyré asserts that Descartes rejects between-world duration because it would mean "introducing time into God" (1957, 122). But why should duration between worlds make God temporal, any more than during worlds? Furthermore, there is no reason to regard a temporal God as 'contradictory' for Descartes and very good reasons to suppose that his God was in fact temporal. See Gorham (2008a).

4.9 Descartes and Early Spinoza

In early works of Spinoza, the influence of Descartes's metaphysics of time is very clear. In the 'metaphysical thoughts' (*Cogitata Metaphysica*), which he appended to his 1663 'synthetic' exposition of Descartes's *Principles of Philosophy* (*Descartes Principiorum Philosophiae*), Spinoza defines duration as "the attribute under which we conceive the existence of created things insofar as they persevere in their actuality" (S 104; G 1, 244). So conceived, he notes, duration is distinct only in reason from the total existence of a thing since "as much as you take away from the duration of thing so much necessarily you take away from its existence" (S 104-5; G 1 244). As for time, "in order that duration may be determined, we compare it with other things that have a fixed and determinate motion, and this comparison is called time" (S 105; G I 244). Such 'clock time', he emphasizes, "is not an affection of things. . . but rather a mode of thinking (*modus cogitatndi*) that we use to explicate duration" (Ibid). In all of this he follows Descartes closely: the distinction between duration and time; the identification of the former as an attribute (continuation in existence) that is merely distinct from the enduring thing; and that classification of the latter as a conventional measure and hence a mere mode of thought. And so Spinoza likewise agrees with Descartes that duration (and time) ceases "when created things cease to exist and begin when created things begin to exist" (S 129; G I 169).

But in a contemporaneous, independent letter ("On the Infinite"), Spinoza retains the distinction between time and duration (and eternity) while seeming to hold that duration is infinite. He associates duration with the existence of modes, which he suggests are infinite by the "force of the cause in which they inhere" (G IV 61, 1-7; C 205). By this he seems to mean that the duration of modes is infinite insofar as "they flow from eternity without which they cannot be rightly understood" (G IV 58, 2-3; C 203). What is noteworthy for our purposes is the duration of modes is conceived as finite precisely because we abstractly divide it into parts: "when they are conceived abstractly they can be divided into parts and regarded as finite" (G IV 61 2-3; C 205). Such division is the source of Zeno-like paradoxes of infinity: "when someone has conceived Duration abstractly, and by confusing it with time begun to divide it into parts, he will never be able to understand how an hour can pass" (G IV 58 5-7; C 203).

So the early Spinoza seems to split from Descartes on the question of infinite duration precisely because he does not attribute parts to duration. This disagreement is evident in his generally sympathetic exposition of Descartes's *Principles of Philosophy*. For instance, in his exposition of the second causal proof of God he conspicuously omits the crucial premise about the mutual independence of the parts of time. Spinoza's critical exposition of the proof makes it instead depend entirely on the assumption that if I were self-created, I would have given myself every perfection. Similarly, Descartes's proof of the law of rectilinear motion turns crucially, though somewhat obscurely, on the assumption that God preserves motion "in the precise form in which it is occurring at the very moment he preserves it" (CSM I 242; AT 8A 64). But Spinoza's puzzling reconstruction proceeds entirely from the

'nature of motion' which supposedly excludes from consideration any "duration that can be conceived as greater than another duration" (G I, 204; S 65). These amendments to Descartes's official proofs illustrate Spinoza's opposition to Descartes on a metaphysical principle – the reality of temporal parts – that had major implications for their respective systems.

4.10 Conclusion

Descartes is a crucial transitional figure in the revolutionary transformation of space/time concepts in the seventeenth century. Through his doctrine of *res extensa*, he reified the indefinite imaginary space of the late scholastics: the space we imagine beyond the world is no different from the matter we perceive in the world itself. Although the space of the early *Le Monde* is a plenum rather than a vacuum, it anticipates many of the crucial attributes of Newton's absolute space: boundless, purely geometrical, continuous, independent of any other being, and clearly conceived. Descartes's view of time was also proto-absolutist insofar as he divorced successive duration from motion and its measure. He was not, however, ready to reify imaginary time. A time independent of everything else besides God, before and after creation, for example, would qualify as a genuine substance. But such a substance would fall outside the dualism of mind and body: neither thinking nor extended in three dimensions. If we stick to the actual world of minds and bodies, duration is best regarded as a universal (transcendental) attribute; if we abstract time from existing things, it is a mere mode of thought. His asymmetrical attitude about indefinite space vs. time therefore seems, like so many Cartesian doctrines, to be a consequence of his strict dualism.

Abbreviations

AT	Descartes, R. 1983. *Oeuvres De Descartes*, 11 vols. Ed. C. Adam and P. Tannery. Paris: J. Vrin. Citation by volume and page.
Brush	Gassendi, P. 1972. *Selected Works of Pierre Gassendi.* Ed. C. Brush. Johnson Reprint Co. Citation by page
C	Spinoza, B. 1985. *The Collected Works of Spinoza,* Vol. I. Ed. E. Curley. Princeton: Princeton University Press. Citation by page.
CB	Descartes. R. 1976. *Descartes' Conversation with Burman.* Ed. J. Cottingham. Oxford: Clarendon Press. Citation by page.
CSM	Descartes, R. 1984–5. *The Philosophical Writings Of Descartes*, 2 vols., Trans. J. Cottingham, R. Stoothoff, and D. Murdoch. Cambridge: Cambridge University Press. Citation by volume and page number.
CSMK	Descartes, R. 1991. *The Philosophical Writings Of Descartes*: *The Correspondence.* Trans. J. Cottingham, R. Stoothoff, D. Murdoch, and

A. Kenny. Cambridge: Cambridge University Press. Citation by page number.

DM Suárez, F. 1866. *Disputationes Metaphysicae*. In *Opera Omnia*. Ed. by C. Berton. Paris: Vives. Citation by disputation, section and paragraph.

DG Newton, I. 2004. *De Gravitatione et aequipondio fluidorum*. In *Newton: Philosophical Writings*. Ed. and Trans. A. Janiak and C. Johnson. Cambridge: Cambridge University Press. Citation by page number.

Essay Locke, J. 1975. *An Essay Concerning Human Understanding*. Ed. P. H. Nidditch. Oxford: Oxford University Press. Citation by book, chapter, section and page number.

G Spinoza. B. 1925 *Opera,* IV Vols. Ed. C. Gebhardt. Heidelberg: Carl Winter. Citation by volume and page number.

Principia Newton, I. 1999. *The Principia: Mathematical Principles of Natural Philosophy*. Ed. and Trans. I.B. Cohen and A. Whitman. Berkeley. Citation by page number.

S Spinoza, B. 1998. *The Principles of Cartesian Philosophy* and *Metaphysical Thoughts*. Trans. S. Shirley. Indianapolis: Hackett Publishing Co. Citation by page number.

Acknowledgements For helpful comments, I would like to thank Edward Slowik and the participants in the New York Seminar in Early Modern Philosophy, Jerusalem, June 2016.

References

Ariew, R. (1987). The infinite in Descartes' conversation with Burman. *Archiv für Geschichte der Philosophie, 69*, 140–183.

Arthur, R. (1988). Continuous creation, continuous time: A refutation of the alleged discontinuity of Cartesian Time. *Journal of the History of Philosophy, 26*, 349–375.

Bexley, E. (2012). Quasi-absolute time in Francisco Suárez's metaphysical disputations. *Journal of the History of Ideas, 22*, 5–22.

Daniel, S. (1981). Seventeenth-century scholastic treatments of time. *Journal of the History of Ideas, 42*, 587–606.

Des Chene, D. (1996). *Physiologia*. Ithaca: Cornell University Press.

Duhem, P. (1987). *Medieval cosmology: Theories of infinity, place, time, void and the plurality of worlds*. Chicago: University of Chicago Press.

Garber, D. (1992). *Descartes' metaphysical physics*. Chicago: University of Chicago Press.

Gorham, G. (2004). Cartesian causation: Continuous, instantaneous, overdetermined. *Journal of the History of Philosophy, 42*, 389–423.

Gorham, G. (2007). Descartes on time and duration. *Early Science and Medicine, 12*, 28–54.

Gorham, G. (2008a). Descartes on God's relation to time. *Religious Studies, 44*, 412–431.

Gorham, G. (2008b). Cartesian temporal atomism: A new defence, a new refutation. *British Journal for the History of Philosophy, 16*, 625–637.

Gorham, G. (2012). 'The twin-brother of space': Spatial analogy in the emergence of absolute time. *Intellectual History Review, 22*, 23–39.

Grant, E. (1981). *Much Ado about nothing*. Cambridge: Cambridge University Press.

Kendrick, N. (1998). 'Uniqueness in Descartes' 'Infinite' and 'Indefinite'. *History of Philosophy Quarterly, 15*, 23–36.

Koyré, A. (1957). *From the closed world to the infinite universe*. Baltimore: Johns Hopkins University Press.

Lennon, T. (2007). The eleatic Descartes. *Journal of the History of Philosophy, 45*, 29–47.

Levy, K. (2005). Is Descartes a temporal atomist? *British Journal for the History of Philosophy, 13*, 627–674.

LoLordo, A. (1997). *Pierre Gassendi and the birth of early modern philosophy*. Cambridge: Cambridge University Press.

Schmaltz, T. (2009). Descartes on the extensions of space and time. *Analytica, 13*, 113–147.

Slowik, E. (2001). Descartes and individual corporeal substance. *British Journal for the History of Philosophy, 9*, 1–15.

Wilson, M. (1999). Can I be the cause of my ideas of the world? (Descartes on the infinite and indefinite). In A. O. Rorty (Ed.), *Ideas and mechanism: Essays on early modern philosophy* (pp. 339–358). Princeton: Princeton University Press.