Penultimate draft: "Space, Monads, and Incompossibility," *Donald Rutherford, ed. Oxford Studies in Early Modern Philosophy, Volume 10, forthcoming.*

Space, Monads, and Incompossibilty

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INTRODUCTION

Leibniz maintains that not all possible substances can be created together – that not all possible substances are *compossible*. God's creation of the actual world precludes his creation of other possible worlds. God's creation of Adam, Eve, and Judas precludes his creation of other possible substances. The doctrine of incompossibility has far reaching implications for Leibniz's philosophical system. It is woven, for example, into his rejection of Spinozistic necessitarianism and his Christian apologetics (see, for example, A 6.4.1385/AG 282; A 6.4.1653/AG 94; GP 6.217-18/H 234-236).[1]

But what are the foundations of incompossibility? What in Leibniz's system grounds the purported incompatibility between possible worlds or possible substances? In previous work, I have defended an underdog answer to this question.[2] What I have called Leibniz's "packing strategy" draws on Leibniz's explicit analogies to games in which the goal is to fill all the places on a board without leaving any empty spaces,[3] as well his suggestion that there is 'as much as there possibly can be, given the capacity of time and space (that is, the capacity of the order of possible existence)' so that 'in a word, it is just like tiles laid down so as to contain as many as possible in a given area' (GP 7.303-4/AG 150-1, see also DM 5/GP 4:430; A 6.4.1396/LOC 239; A 6.4.1616-17/LOC 305; A 6.4.1399/LOC 246-7; A.6.3.472/LOC 45; GP 7:290/RM 9). The central thought of the packing strategy is that incompossibility is grounded in spatial (and temporal) exclusion.[4] Having created Adam, Eve, Judas and the rest, God cannot co-create merely possible Adam*, Eve* and Judas* because there is literally no place for them in the order of 'time and space.'

It is fairly easy to see how the packing strategy might be pursued with respect to possible worlds constituted by extended, material substances. Consider a finite world filled everywhere with sheep (and sheep within sheep all the way down if you like). Is a possible goat compossible with such a plenum sheep-world? Presumably not. If the world is finite and filled with sheep, then there would literally be no room to create a possible goat in the plenum sheep-world. It is worth noting that this is not to say that God couldn't have created a possible goat. He could. His doing so, however, would require that he not create one or more of the sheep. In maximizing the perfection of the world, God's task, as it were, is to create the greatest compossible collection of substances so that there is, well, 'as much as there possibly can be, given the capacity of space and time' (GP 7.303-4/AG 150-1). Moving from finite corporeal worlds to infinite corporeal worlds makes the details more complicated (and interesting!) but the core, intuitive picture remains: two sets of corporeal substances are incompossible if there is, quite literally, not enough room to create all of them.[5]

As we move from extended, corporeal substances to unextended, immaterial monads, however, it becomes much harder to understand the intended lesson of Leibniz's packing analogies. Some may be tempted to suppose 'so much the worse for Leibniz's monadic metaphysics.' For some commentators have argued that Leibniz's monadic metaphysics is unstable anyway, or that he is, in fact, committed to corporeal substances throughout his career.[6] Others may be tempted to look for alternative grounds that might play a role analogous to space for immaterial substance worlds. I've argued, for example, that it is possible to preserve some of the hallmarks of the packing strategy by substituting formal exclusion for spatial (and temporal) exclusion.[7] If, for example, we interpret Leibniz as allowing for transworld identities, and Eve and Eve* are transworld identical in virtue of their essences while nonetheless differing in their non-essential properties, then Eve and Eve* may be incompossible on pain of violating Leibniz's Law.

Be all that as it may, it would be nice to do better. It would be nice to have an intuitive picture of how the packing strategy might be applied to monadic worlds and monads. It would be nice to have a picture that applies Leibniz's packing analogies directly to immaterial substances and shows how the incompossibility of monads might be grounded immediately in spatial (and temporal) exclusion. That – for better or for worse – is the task of the present essay.

The discussion that follows is divided into three main sections. The first section sets the stage by taking up some essential questions about the relationship between monads and space. The second section argues that – with a better understanding of that relationship – it is possible to see how the packing strategy can be applied quite directly, even intuitively, to monadic worlds and substances. The third section argues that thinking through the application of the packing strategy to monadic worlds highlights an important, neglected Leibnizian commitment and reveals surprising affinities between the packing strategy and recent cosmological interpretations.[8]

1. SPACE AND MONADS

Are monads *themselves* spatially located? Do they themselves stand in spatial relations to one another? Or should we rather suppose that monads enjoy only a kind of derivative spatiality? That they are spatial, for example, in the sense that they represent bodies that may be said to stand in spatial relations to one another. Commentators have disagreed. An earlier generation of scholars assumed that monads are themselves spatially related to one another.[9] More recent scholars have tended to favor less realist views.[10] Most recently, there are signs that the pendulum may be poised to swing back towards the more realist end of the spectrum.[11]

My own view is that we have to be very careful about how we talk about the spatiality of monads. They are not in Aristotelian places nor in Newtonian space. They are not – in Leibniz's technical sense – parts of things that have places (e.g. bodies) (A 6.4.1673; GP 2:268/LDV 302). They are not located at points in space (since space is continuous and reality is discrete). They are not located in ideal space (a mere abstraction from spatial relations). But – provided that we are careful – I think the views of the earlier generation (and the most recent) are essentially on the right track. [12] As I read him, Leibniz thinks, for example, that my dominant monad is literally somewhere within the boundaries of my body. That if I'm in Boston, my dominant monad – my soul – is also in Boston. That if I'm in Boston and you are in San Francisco, our dominant monads – our souls – are literally thousands of miles apart. For ease of expression, let's say that on such a reading, monads are *spatial per se*.

Naturally, I believe there are good reasons for thinking that Leibniz embraces the view that monads are spatial per se. Such a view – I think – is strongly implied by Leibniz's texts when, for example, he talks about monads as being 'everywhere in matter' (LDB 24; see also GP 7:565, LDV 332, GP 6:56/Huggard 80, GP 6:598/AG 207, GP 4:492/NS 46), as having 'a certain kind of situation in extension' (LDV 266) and when he describes the dominant monad of an insect as being 'only on one side' and remaining 'always in a certain part' (GP 2:100/AG 88, see also GP 2:135/LA 170). It is encouraged by the views of his predecessors (who generally held that all things have to be 'somewhere') and the views of his immediate successors in the German tradition (including the early Kant).[13] It allows us to make sense of the connections between his work on the foundations of geometry, his relationalist views of space, and his fundamental ontology. Furthermore, it is in no way ruled out by the idealist or nominalist threads in his thought.[14] Finally, the spatiality of monads dovetails with what is, I think, the best way of understanding the relationship between monads and bodies. If, as I think, Leibnizian bodies are constituted by monads, then it is (I think) difficult to see how bodies could be spatial without the monads constituting them being spatial as well.[15]

Of course, not everyone will agree, and the subtly of Leibniz's views on the spatiality of monads, it seems to me, leaves room for debate. For the sake of the current discussion, however, I'd like to set aside the question of *whether* monads are spatial per se to consider a neglected question that takes it for granted that they are. If we suppose – because we are convinced, or in the spirit of exploration – that monads are spatial per se, *how* are they, or might they be, spatial per se? That is, assuming that monads are themselves spatially related to one another, how is it, or how might it be, that unextended, immaterial, mind-like substances occupy spatial locations? And how, indeed, especially in light of Leibniz's embrace of spatial relationalism?

In trying to answer the question of how monads might be spatial per se, it proves helpful, I think, to begin with Leibniz's views on space.[16] Leibniz identifies space with an abstract ordering or structure of situations (*situs*). Intuitively, a situation (*situs*) is simply a relative location. Thus, the end points of two lines of equal length, the vertices of two triangles with equal sides, and the circumference points of two circles with equal radii all have the same (relative) situations (*situs*). In his technical studies on the geometry of situation – collectively known as his *analysis situs* – Leibniz implies more precisely that situation may be defined in terms of congruence: "two collections of objects have the same reciprocal situations if and only if one collection is congruent with the other."[17] In identifying space with an ordering of situations, Leibniz is careful to specify that space is not a *concrete* ordering of *actual* situations but an *abstract* ordering of *possible* situations. Thus, Leibniz writes in his *Third Letter to Samuel Clarke* 'I hold space to be … an order of co-existences as time is an order of successions. For space denotes, in terms of possibility, an order of things which exist at the same time, considered as existing together, without inquiring into their particular manner of existing' (GP 7:363/L 682). Similarly, in his *Fifth Letter to Clarke*, he writes 'I don't say that space is an order or situation, but an order of situations, or an order according to which situations are disposed, and that abstract space is that order of situations when they are conceived as being possible' (GP 7:415/L 713-14).

Although Leibniz's relational account of space as an abstract ordering of situations runs contrary to some commonplace, substantivalist intuitions, his approach is in many ways congenial to sophisticated, contemporary approaches to space (or spacetime) where spaces (or spacetimes) are often constructed by starting with a set of points and adding structure – e.g. affine structure, metric structure, etc.[18] Nonetheless, there is a crucial difference between Leibniz's views on space and even sophisticated contemporary accounts. Today physicists and philosophers of science take it for granted that the structure of actual space is contingent and non-Euclidean. The advent of hyperbolic geometry in the early nineteenth century, made it possible to imagine alternatives to Euclidean geometry. And with the advent of non-Euclidean geometry, it became easier to suppose that the structure of the space of the actual world is contingent in the sense that the space of the actual world could have had a different structure than the structure it in fact does have. With the successes of the theories of special and general relativity, it became widely accepted that the structure of the space of our world is in fact non-Euclidean.

It should come as no surprise that – working long before such modern developments – Leibniz, in contrast, assumes that the structure of space is both necessary and Euclidean. Indeed, throughout his career, Leibniz pursued a 'logicist' account of the foundations of geometry.[19] He thought that traditional appeals to axioms and postulates betray a need for better definitions from which the truths of geometry would follow analytically and necessarily. With a proper definition of a line, for example, he thought that we could do away with both Euclid's axioms characterizing the nature of a line and Euclid's postulate that there is at least one line between any two points.[20] Furthermore, having identified space with an abstract ordering of situations, Leibniz could see geometry as a direct study of the structure of space itself. For Leibniz, truths about lines, planes and three-dimensional objects are not just abstract geometrical truths, they are also truths about the nature of space itself. If those truths are necessary, analytic truths (as his logicism insists), however, then it is clear that truths about the nature of space must also be necessary, analytic truths. In section 2 below, we'll see how Leibniz's understanding of the structure of space as being both necessary and Euclidean shapes how he could be expected to respond to important objections to his views on incompossibility.

Moving from space to monads, it is worth emphasizing that if we suppose that monads are spatial per se, we needn't – indeed shouldn't – suppose that monads are situated in space understood as an abstract structure. For Leibniz, abstract space is a wholly ideal object, like an ideal square, or the number 4, and nothing concrete, nothing real like bodies or monads, could literally be *in* an abstract object. Nonetheless, abstract space for Leibniz is an abstraction from, and idealization of, the concrete spatial relations holding among actual objects (GP 7: 400-402/Alexander 69-72). Abstract space is an abstraction in that it eschews structure that might be present in the actual world. It is, for example, continuous and never changing. Abstract space is idealized in that it may include structure that is missing in created worlds. It is, for example, a structure that includes all possible (not just actual) situations. Nonetheless, while created objects – dogs, cats, monads – can't be in abstract space, they can stand in well-founded, concrete spatial relations that are isomorphic to the structure of abstract space.[21] My dog and my cat can't be in an abstract structure, but they can be three feet apart and that well-founded, concrete relation of spatial distance – Leibniz maintains – must be isomorphic with the necessary, Euclidean structure of abstract space (GP 4:494-95/NS 46).

Now Leibniz, of course, maintains that all well-founded, concrete relations must be intelligibly grounded in the non-relational properties of their relata.[22] Well-founded, concrete spatial relations must therefore be grounded in the non-relational properties of their relata, and if there are – as we have been assuming – well-founded, concrete spatial relations holding amongst monads, then those well-founded, concrete spatial relations will have to be grounded in the non-relational properties of monads (C 8-10/MP 133-134). But what in monads could possibly intelligibly ground concrete spatial relations? The question sounds hard, but the answer is, I think, on reflection, obvious. Spatial relations between monads must, for Leibniz, be grounded in the points of view of monads. Indeed, Leibniz says as much:

> To be in a place seems, abstractly at any rate, to imply nothing but position. But in actuality, that which has a place must express place in itself; so that distance and the degree of distance involves also a degree of expressing in the thing itself a remote thing,

either of affecting it or receiving an affection from it. So, in fact, situation really involves a degree of expressions. (C 9/MP 133)

Leibniz's thought here, I suggest, is that substances that have actual positions must express those positions, that is, they must have points of view.[23] To the untutored, it might seem in the abstract that a monad could be spatially located simply in virtue of bearing an ungrounded ('extrinsic') relation to other things or positions. But those in the know – Leibniz thinks – will recognize that in order to be actually spatially located, a subject must bear well-founded, concrete spatial relations to other things or positions. And in order to bear well-founded, concrete spatial relations to other things or positions, a subject must express its place – it must have a point of view that represents other things or positions as being nearer, more distant, etc. Leibniz is again turning our ordinary ways of thinking inside out. When I see my daughter across the room, I'm inclined to think that the way she appears to me is partially determined by where she is positioned with respect to me. She takes up much of my visual field and I see her face because she is relatively close to me and facing me. For Leibniz, things go the other way around. I am relatively close and facing my daughter in part because of the way that she is represented in my visual field. More generally, a monad's actual position, for Leibniz, is determined by its point of view taken together with all the other points of view of all the other monads that co-exist with it.

Pulling all this together: If we suppose – again, either because we are convinced, or for the sake of exploration – that monads are spatial per se, how might they be spatial per se? Leibniz denies that monads are in anything like a substantival Newtonian space. The fundamental ontology of monadic worlds is exhausted by monads and their properties (LDV 331-3). If monads are spatially related to one another, they must therefore be spatially related to one another in virtue of well-founded, concrete spatial relations, and (given Leibniz's views on relations) those well-founded, concrete spatial relations must be grounded in the properties of monads, and in particular in monadic points of view. If monads are spatial per se, therefore, they are spatial because their points of view ground concrete spatial relations that are isomorphic with the abstract spatial relations set out in the necessary, a priori science of geometry. Leibniz has ingeniously upended our ordinary ways of thinking about space thrice over: it is in virtue of having points of view that monads stand in spatial relations to one another, and it is in virtue of their standing in spatial relations to one another that monads have spatial positions (*situs*), and it is in virtue of their having spatial positions that monads are spatial per se. With this rough picture in hand, we are ready to take up anew the question of how Leibniz could apply the packing strategy in order to understand the grounds of incompossibility for worlds exhaustively constituted by monads.

2. THE PACKING STRATEGY AND MONADIC WORLDS

If monads are spatial in the sense just sketched, we can, I think, begin to understand Leibniz's packing analogies – even when applied to monadic worlds – in ways that are quite intuitive, indeed quite literal. As we've just seen, Leibniz's spatial relationalism implies that if monads are spatially related to one another, each monad will occupy a position (*situs*) in a network of spatial relations that includes the positions (*situs*) of all the other monads that are spatially related to it. Which position (*situs*) a monad occupies within that network is determined by its point of view in connection with the points of view of all the other co-existing monads. From this alone, I think we can get a rough picture of how Leibniz's packing analogies can be applied directly to monads themselves. Assuming – as Leibniz insists – that the actual world is a plenum, every spatial position (*situs*) in the actual world is occupied by a monad. Every merely possible monad is thus incompossible with the actual world in the sense that the creation of any merely possible monad would require displacing at least one actual monad in order to make room for the merely possible monad. Likewise, for collections of monads. If the actual world is a plenum world, then every collection of merely possible monads is incompossible with the actual world in the sense that the creation of any collection of merely possible monads would require displacing a collection of actual monads in order to make room for the potentially 'incoming' collection of merely possible monads. Incompossibility is grounded in the spatial (and temporal) exclusion of one set of monads by another set of monads. Having created one set of monads, God cannot co-create another set of monads because there is literally no place for them the order of 'time and space'.

That's the intuitive, rough picture at least. There are subtle questions lurking in the details – questions that, as far as I know, Leibniz never thought through but that we could think through on his behalf. So, for example, we might ask if it is possible for two monads to occupy the same situation (*situs*) in a network of spatial relations? This would be the Leibizian version of the question about how many angels can dance on the head of a pin – a question, of course, not about how big angels are but about whether two immaterial beings can occupy the same place.[24] The relevance of the question to the compossibility of monads is obvious. If two monads can occupy the same *situs*, then, one might suppose, there will always be room for potentially 'incoming' monads. For it seems that in that case, we could, as it were, simply double book, triple book, etc. every position. So, let's ask again, can two monads occupy the same position (*situs*)?

Perhaps the answer is 'no'. One could suppose that for two monads to occupy exactly the same position (*situs*), they would have to have exactly the same point of view. After all, monads occupy positions in virtue of their points of view, and so it seems plausible that for two monads to occupy exactly the same position, they would have to have exactly the same point of view. And one might suppose that – on pain of violating the identity of indiscernibles[25] – two monads that shared the same point of view, would have to be identical. This thought might gain further traction from Leibniz's doctrine of marks and traces (A 6.4.1541/AG 41). Absent that doctrine, one might think that two monads could have the same point of view at a time, and yet differ from one another in virtue of their having different points of view at different times. Leibniz's doctrine of marks and traces, however, implies that if two monads have the same point of view at any time, they must have the same point of view at all times, or at least at all times during which both monads exist. All the more reason to think that any two monads that occupied the same place would have to have exactly the same point of view, and would thus be identical on pain of violating Leibniz's Law.

On further reflection, however, perhaps the answer is 'yes' after all. For the crucial supposition that any two monads that have exactly the same point of view must be indiscernible is far from ironclad. It seems possible that two monads might have exactly the same point of view, and thereby occupy exactly the same position relative to a given set of monads, without being qualitatively identical. Suppose, for a simplified example, that two monads do represent all the same things, that they represent them all as being from the same visual angles, etc. but that they nonetheless differ by a uniform shift in their overall clarity and distinctness. We might think of that shift as being analogous to the difference in my point of view when I'm wearing my glasses and when I'm not wearing my glasses. When I take my glasses off, the quality of my visual field changes dramatically, but my point of view remains the same in the most relevant sense. Or, for another, perhaps more Leibnizian, example, we might suppose that our two monads differ by a uniform shift in whatever quality it is that accounts for the difference in my visual field when I am clear-headed and wide awake as compared to when I am dizzy or sleepy. When I go from being clear-headed and wide awake to being dizzy or sleepy my visual field undergoes an important shift – a shift that Leibniz recognizes and puts to theoretical use (see, for example, GP 6:610-611/AG 216) – but not a shift that would appear to correspond to a relevant difference in point of view. When I get tired, my visual field degrades in some sense, but I don't (thereby) acquire a new point of view, nor do I (thereby) acquire a new *situs*.

If that is right, we should, on Leibniz's behalf, say that two monads can indeed occupy the same position (since we can imagine two qualitatively discernible monads that nonetheless have the same point of view and thus that have the same *situs*). We should recommend, in short, that he grant that two angels might, indeed, dance on the head of a pin. But even this concession needn't undermine the applicability of Leibniz's packing analogies to monadic worlds. For, again, the core idea of the packing analogies (as applied to monadic worlds) is that a monad is incompossible with a set of other monads if and only if there is no *situs* for that monad given those other monads. The 'two angels' result does nothing to undermine that core thought. All that it shows is that there is more than one way in which a monad might find a *situs* relative to a set of monads. It might find a *situs* that is wholly unoccupied or it might find a *situs* that is occupied by another monad but only if that monad has the same (non-qualitatively identical) point of view. That little extra concession, however, leaves intact the thought that a possible monad might not be able to find a place (*situs*) relative to a set of monads because it satisfies neither of the stated requirements, that is, because there is no unoccupied *situs* for it to occupy and there is no taken *situs* that is occupied by a qualitatively distinct monad with the same point of view. The concession obtained by the 'two angels' result thus leaves in place the core, intuitive thought that a possible monad may be incompossible with a set of other monads because there is no place, no *situs*, for that monad given that set of other monads.

Having fussed over the question of whether two monads could occupy the same position (*situs*), here's another detail we could fuss over: if we think of one set of monads as prima facie precluding the creation of other set of monads because the former leaves no room (*situs*) for that other set of monads, might it not be possible to simply add new places (*situs*) to make room for the prima facie incompossible 'new comers'? This is another difficult question that, as far as I know, Leibniz never answers for us. If we take up the task of replying on his behalf, we should begin by noting that the question itself might be heard in two distinguishable ways. In the first way, the thought would be that we can always find room for incoming monads by shifting already existing monads to new places thus making room for incoming monads.[26] In the second way, the thought would be that we can always find room for more incoming monads by allowing the incoming monads to bring with them, as it were, their own spatial network.

I think it is relatively easy to see how Leibniz should respond to our question taken in the first way, that is, how Leibniz should respond to the thought that room (*situs*) for an incoming set of monads could always be found by simply shifting the already existing monads to new *situs* in the infinite spatial network they ground. By way of close analogy, suppose we think of the natural numbers as being arrayed on a line with a little tick mark being written below each number. It is easy to imagine – Hilbert Hotel style – moving all the numbers up a tick, freeing up ticks at the front.[27] But this trick works only if we imagine that the ticks have an existence independent of the numbers themselves. If they do not, then it will make no sense to shift the numbers relative to the ticks. If the ticks are dependent upon their numbers, the proposed shift is merely an illusion. Likewise, for the shift proposed in the first way of taking our question. To imagine that we might shift a set of monads to new *situs* in an infinite network of spatial relations is to afford an ontological independence to the spatial network that Leibniz, in his rejection of spatial substantivalism, explicitly rejects. Leibniz should deem such a shifting to make room for incoming monads as being no more a real possibility than shifting the entire world ten miles to the west, or rotating it clockwise ninety degrees (GP 7: 373/Alexander 38).

If that's right, Leibniz should simply deny that we can always find room for incoming monads by freeing up places *within* an already existing spatial network. But that still leaves open the possibility entertained by the second way of taking our question above. That is to say, it leaves open the possibility that an incoming set of monads might simply bring with it its own network of additional spatial relations. It leaves open the thought that any two sets of monads should be compossible for the Leibniz precisely *because* spatial relations are grounded in monads.

Knowing what we know as contemporary philosophers, I think we should grant the objection. Suppose we start with a set of monads situated in an infinite, three-dimensional, relational spatial network. Further suppose that every *situs* defined on that network is occupied. We could still imagine the creation of another set – even an infinite set of additional monads – with each monad occupying its own *situs*. For we could imagine another infinite space disconnected from the first space we imagined. We would, in effect, have two infinite, spatial worlds, that are simply not spatially connected to one another.[28] Alternatively, we could open up new dimensions to our initial world. Even supposing that all the *situs* of our three-dimensional world are occupied, we could still imagine another three-dimensional hyperplane with infinitely many *situs* left unfilled. And, of course, we can turn this trick as often as we like, making room for more and more monads in more and more hyperplanes as often as we wish.

The possibility of creating ever more *situs* for incoming monads should thus strike us as a live possibility and thus as a real threat to Leibniz's account of incompossibility as we have been interpreting it here. But I think the same possibility would look rather different to Leibniz. Most obviously, he would balk at the suggestion that we might make room for incoming monads by opening up new spatial dimensions. For as we've seen, Leibniz took the three-dimensionality of space to be a necessary truth (GP 323/H 336). For him the possibility of n>3 dimensional spaces would not have been a live possibility. He would – wrongly, but understandably – conclude that our imagined hyperplanes are illusions on a par with the supposition of a biggest number or a greatest speed.[29] But what about the possibility of disconnected spaces? Would Leibniz allow that we might find room for otherwise incompossible monads by simply allowing them to occupy a disconnected space (or disconnected spaces)? Would he allow that creation as a whole might include multiple spatially isolated worlds? With recent proponents of cosmological readings of Leibniz's views on incompossibility, I think Leibniz's answer to this question is 'no.' Leibniz's deepest reason for denying this possibility, however, has not yet been fully appreciated. Bringing it to light should not only lend further support to the internal coherence of Leibniz's packing strategy, but also reveal surprising affinities between the packing strategy and recent cosmological interpretations.

3. A NEGLECTED EQUIVALENCE AND A NEW ROUTE INTO THE COSMOLOGICAL SOLUTION

In a letter to Des Bosses of 15 February 1712, Leibniz writes

> God not only considers single monads and the modifications of any monad whatsoever, but also sees their relations, and the reality of relations and truths consist in this. Foremost among these relations are duration (or the order of successive things), situation (or the order of coexisting), and intercourse (or reciprocal action) …. (LDB 233).

There are many interesting things going on in this passage. There is the suggestion that the reality of relations is (at least partially) grounded in God's perceptions. There is the suggestion that time is the order of successive things and the beginnings of a clarification of how monads may be said to interact with one another. What is most important for our present purposes, however, is Leibniz's proposed equivalence between the relation of situation and the order of coexisting (*situs seu ordo coexistendi*). Going in one direction, it suggests the mundane thought that if two things are co-spatial (at a time) then they must co-exist (at that time). Going in the other direction, however, it suggests the more intriguing thought that if two things are co-existent (at a time) then they must be co-spatial (at that time).

There can be no doubt that Leibniz is firmly committed to the equivalence of co-spatiality (at a time) and coexistence (at that time). It pops up already in early writings dating to the mid-1670's (see, for example, A 6.3.584/DSR 107, A 6.3.581/DSR 103 and LH 4.6.12F, but see also the difficult passage at A 6.3.512-513/DSR 67). In a piece from 1676, for example, Leibniz tells us that there are not 'any bodies except those which are at a certain distance from us. For if there were any, it could not be said whether they exist or do not exist now, which is contrary to the first principle' (A 6.3.584/DSR 107). It persists in later revisions made to those early writings. In one revision, for example, Leibniz writes, 'Extension, which is perceived by sight and touch only, involves number, but adds situation to it, or the order of coexistence' (L 92). We find the same equivalence repeated in a piece dated to the late 1690's, where Leibniz tells us that 'in these two, time and place, there consists the order of things which exist either successively or simultaneously' (C 14/MP 176). Likewise, in a letter to Bayle of 1702, Leibniz tells his great correspondent 'But space and time together constitute the order of possibilities of the one entire universe, so that these orders – space and time, that is – relate not only to what actually is but also to anything that could be put in its place' (GP 4:568/L583). Finally, in a piece written near the end of his life that has been entitled *The Metaphysical Foundations of Mathematics*, Leibniz tells us that 'Space is the order of coexisting things, or the order of existence for things which are simultaneous. … *Situs* is a mode of coexistence'; and later in the same piece, '*Situs* is a certain relation of coexistence between a plurality of entities' (GM 7:17/L 666-667; GM 7:25/L 671).

A full treatment of Leibniz's reasons for accepting his striking equivalence would require at least another paper in its own right. It is nonetheless easy to see a number of considerations that may have encouraged Leibniz in his conviction. Leibniz sometimes suggests that the equivalence of co-spatiality (at a time) and co-existence (at the same time) is essentially a conceptual truth. So, for example, in an early piece entitled *My Principle is: Whatever Can Exist and is Compatible with Others, Exists*, Leibniz complains:

> To introduce another genus of existing things, and as it were another world which is also infinite, *is to abuse the name of existence*; for it cannot be said whether those things exist now or not. But existence, *as it is conceived by us*, involves a certain determinate time; or, we say that that thing exists of which it can be said at some certain moment of time, 'That thing now exists'. (A 6.3.581/DSR 103, emphasis added).

Here the thought – or at least part of the thought – seems to be that our very concept of existence entails co-existence in the sense of being co-spatial at a time. On this line of thought, to say that there might now exist two worlds that are spatially disjoint from one another, would be to misuse, or confuse the very concept of existence.[30] For another consideration, Leibniz sometimes suggests that the equivalence of co-spatiality (at a time) and co-existence (at that time) follows from what he takes to be a necessary disjunct, namely, that everything either exists now or does not exist now. This consideration can be seen in the passage just cited in Leibniz's emphasizing that if there were more than one infinite world then "it cannot be said whether those things [in that world] exist now or not. But existence, as it is conceived by us, involves a certain determinate time; or, we say that that thing exists of which it can be said at some certain moment of time, 'That thing now exists'" (A 6.3.581/DSR 105). This thread in Leibniz's thinking suggests that if there were two disjoint worlds, the events in one world would be neither simultaneous nor non-simultaneous with events in the other world. But, Leibniz suggests, it is a conceptual truth that for everything that exists it either exists now or does not exist now. The hypothesis that there might be two disjoint worlds may be ruled out by *reductio*. Finally, Leibniz might have seen his equivalence as following from the connectedness of Euclidean geometry itself. For, of course, it is one of the fundamental principles of Euclidean geometry that there exists a line – a connection – between any two points. In thinking of space as necessarily having a Euclidean structure, it would have been natural for Leibniz to assume that there must exist a spatial relation – a straight line as it were – between any two co-existing things. The geometry of his time may have thus provided another reason in support of Leibniz's conviction that the notion of spatially disconnected co-existences is literally unthinkable.[31]

Whatever Leibniz's reasons were for accepting his equivalence, it is clear that it has crucial implications for his understanding of incompossibility.[32] For it directly blocks the objection raised at the end of the last section. Today, it seems obvious that there might be worlds that are not just causally but also spatially disconnected from one another. Given two such worlds A and B there would be no spatial path – no line as it were – connecting an inhabitant of A to an inhabitant of B. It is therefore natural for us to object to Leibniz's account of incompossibility that even if God must create creatures *somewhere*, God could always create more substances by packing them into ever more spaces that are disconnected from one another. Leibniz's equivalence, however, blocks precisely this possibility. If the order of co-existence (at a time) just is the order of space (at that time), then clearly God cannot create two worlds that are co-existent (at a time) without their being also co-spatial. If the order of co-existence (at a time) just is the order of space (at that time), then clearly God cannot even create two possible substances that are co-existing (at a time) without their being co-spatial (at that time). Leibniz's underappreciated equivalence thus turns out to be a crucial pillar of internal support for his doctrine of incompossibility.

Considered in the context of his views on the relationship between monads and space, Leibniz's equivalence also has important implications for how we might understand the relationship between packing and cosmological interpretations of incompossibility.

As we noted in the first section, Leibniz maintains that spatial relations must be grounded in the intrinsic properties of monads, and in particular in monadic points of view. If the order of co-existence (at a time) just is the order of co-spatiality (at that time), however, that implies that if two monads are to co-exist (at a time) they must be co-spatial (at that time), and that in turn implies that their points of view must be capable of grounding spatial relations between them. But if spatial relations are grounded in points of view, that implies that the points of view of co-existing monads must be such that they agree sufficiently – that they must "mesh" in such a way – that they are capable of grounding spatial relations, that is, by Leibniz's equivalence, that they are capable of grounding the order of co-existence (at a time).

Now, of course, we would ideally like to know in detail exactly what is required for the points of view of two monads to mesh in such a way that those points of view may ground relations of co-spatiality and co-existence. Even without a precise answer, however, we can see that such a constraint will be substantive, that is, that such a constraint will rule out the co-existence of a least some possible substances. So, for example, a meshing constraint seems sufficient to rule out the co-existence of two monads – *a* and *b* – whose points of view have nothing to do with each other at all. For it is hard to see how two monads whose points of view have nothing to do with each other at all could intelligibly ground one spatial relation rather than another, and therefore (by the principle of sufficient reason) how they could ground any spatial relation at all. Other options seem to be ruled out as well. Consider two sets of monads, set A and set B. Suppose all the monads in set A represent A's members as standing in coherent spatial relations with one another, and all the members of set B do the same for the members of set B. But further suppose that no member of set A represents a member of set B, and no member of set B represents a member of set A. Given Leibniz's equivalence and his views on space, set A and set B would also seem to be incompossible. Indeed, they would seem to be incompossible for exactly the same reason that *a* and *b* seem incompossible. For, again, it is hard to see how two sets of monads, the respective members of which have nothing to do with one another, could intelligibly ground one spatial relation rather than another, and therefore (by the principle of sufficient reason) how they could ground any spatial relation at all.

It is worth noting that although Leibniz's equivalence places substantive constraints on creation, it does not seem to require the sort of all or nothing dependences suggested by logical interpretations of Leibniz's views on incompossibility. Logical solutions typically see particular monads as being world-bound in the sense that they suggest that each monad can exist with all and only its worldmates.[33] If Ann, Bob, and Carla constitute a world, Ann can't exist without Bob and Carla, and none can exist with Doug on pain of logical contradiction. Leibniz's equivalence of co-existence and co-spatiality – even given his views on monads and space – don't appear to make any demands as strong as that. It is possible that the points of view enjoyed by Ann and Bob could ground spatial relations between just the two of them, and it is even possible that Doug's point of view might allow him to stand in spatial relations to Ann, Bob, and Carla or any subset of them. Perhaps the easiest way to see this is to suppose that Ann, Bob, and Carla constitute a world and represent themselves and Doug as existing in their world. It seems that we can imagine another world that contains only Ann and Bob but in which Carla and Doug do not exist as well as a world in which Ann, Bob, Carla and Doug all exist. The constraint imposed by Leibniz's equivalence and his views on monads and space, while placing substantive constraints on co-creation, does not suggest that the existence of any one monad entails or is logically precluded by any other monad. It thus appears to strike a middle ground between allowing any collection of substances to be compossible and requiring that each monad must be ganged to precisely to all and only its worldmates.

If all that is right, then I think we have stumbled onto a new route into a version of the cosmological interpretation of Leibniz's views on incompossibility. In their now canonical presentation of that interpretation, James Messina and Donald Rutherford suggest that, for Leibniz, God's creation is constrained by a commitment to create a single world that is unified by space, time and quasi-causation.[34] They suggest that the actual world is incompossible with various merely possible substances because the creation of those merely possible substances would spoil the space-time-causation structure of the world, leaving God with a creation that is a collection of monads but not a *world*.[35] Incompossibility, on their reading, is thus ultimately grounded in God's "objective of actualizing a *world*" as opposed to some non-world totality that is, as it were, either less (e.g. a single substance) or more (e.g. a world plus additional substances) than a world.[36]

As a general approach to understanding Leibniz's thinking about incompossibility, cosmological interpretations may appear to be open to a pair of philosophical worries. The first worry concerns why God should be so interested in creating a *world* rather than a more plentiful collection of substances. In a number of texts, Leibniz suggests that in creating, God seeks to maximize existence. Leibniz tells us, for example, that "the greatest amount of essence that can exist, does exist" (A.6.3.472/DSR 21-2; see also GP 7. 302-8/L 486-491; GP 1: 331/L 211; GP 7: 290/RM 9-10). Furthermore, a commitment to maximizing existence seems deeply woven into Leibniz's philosophical thought. It would seem to follow, for example, from his optimism about existence. Leibniz thinks that God's creating at all shows that existence is good. But if existence is good, it seems that more existence must be better. It is hard to see then how Leibniz's God could have a reason for creating less being rather than more. A commitment to maximizing being likewise seems to be taken for granted in Leibniz's insistence that the best of all possible worlds must be a plenum world. It is a familiar line of thought from Leibniz that there are no vacua in the actual world because in any vacuum God could create more, and – again because existence is good – more being would always be better than less (GP 7: 378/AG 332). But why then – if a world-plus creation is possible – should God limit himself to creating merely a world. Why not create more?[37]

The second worry concerns the kind of constraint that compossibility is supposed to place on creation. Leibniz is facing the question of why God doesn't create other merely possible substances. It would be easy for him to reply that the creation of other possible substances would make the world worse over all. Merely possible Ann* doesn't exist because including Ann* in the actual world would make the actual world worse than it is. But Leibniz does not seize on this easy response. He seems rather to envision compossibility as being a more robust, independent constraint on creation. God doesn't create merely possible Ann* not because, or not simply because, creating Ann* would make the world less good, but because Ann* is incompossible with the actual world. Because, in short, God *can't* create the actual world together with Ann*. Insofar as cosmological interpretations allow that – strictly speaking – God could create more than a world, they seem to make incompossibity rest on a less-than-necessary constraint. If one thinks – as I do – that compossibility must represent an absolute constraint on creation, then one will think that cosmological interpretations that allow that God could have created something more than a world don't yield the kind of constraint that Leibniz needs.

If we take seriously Leibniz's equivalence between co-existence and co-spatiality, however, things begin to look better for broadly cosmological interpretations of incompossibility. For if co-existence entails co-spatiality, and co-spatiality puts substantive constraints on what monads can co-exist – so that, for example, only monads with meshing points of view can be co-existents – then we seem to have found a robust, absolute ground for incompossibility. A monad will be incompossible relative to a set of other monads if its point of view does not mesh in a suitable way with their points of view. Given such a constraint there is no reason to think that all monads will be compossible; indeed, there is good reason to suppose that incompossibility will be the norm rather than the exception. On this new route into the cosmological approach, creating a world in which monads are spatially related to one another is not a contingent feature of creation, it is an absolute, conceptual necessity ultimately grounded in

Leibniz's ur-thought that if two things are to co-exist they must, on pain of contradiction, be spatially related to one another.

If that's right, it shows, I think, that the idea driving the packing strategy is, in fact, consistent with at least the spirit of cosmological interpretations. Taking a step back, Leibniz's intuitive thought is that monads have to be created somewhere. Incompossibility arises when the creation of one set of monads spatially excludes another set of monads. We can think of that exclusion – à la the packing strategy – as arising from the fact that the creation of one set of monads would leave no place, no *situs* for the other set of monads – or – à la the cosmological strategy – as arising from the fact that the points of view of one set of monads would not mesh with the other set of monads in such a way that they could ground spatial relations between those monads. To a large extent – to an extent that I think ought to be encouraging – the packing and cosmological strategies turn out to have deep, unappreciated affinities.

CONCLUSION

For many years, discussions of Leibniz's views on compossibility resembled a collegial version of trench warfare. With the exception of a few hybrids, commentators typically settled into one of two well-fortified camps. Logical interpretations sought to ground incompossibility in logical connections holding between the complete concepts of possible substances. Lawful interpretations sought to ground incompossibility in God's aim to create a world that is governed by harmonious laws of nature. The debate was rich and productive and with time it exposed well the relative strengths, weaknesses and implications of both interpretations.

In recent years, new ways of thinking about Leibniz's views on incompossibility have opened up. One such way is represented by the packing strategy. It suggests that Leibniz's deepest thought is that not all possible substances are compossible because the creation of some possible substances may spatially exclude the creation of other possible substances. Another such way is represented by cosmological interpretations. They suggest that Leibniz's deepest thought is that not all possible substances are compossible because the creation of all possible substances would not satisfy God's objective of creating a *world*.

In this paper, I have above all attempted to show how the packing strategy might be extended to its most difficult case, namely, the case of infinite, monadic worlds. We began by considering how monads might be related to space. I argued that, for Leibniz, monadic points of view ground spatial relations, the Euclidean structure of which Leibniz takes to be absolutely necessary. In that case, however, one set of monads may be incompossible with another set of monads in virtue of the fact that the creation of one set of monads would not leave any room (any *situs*) for the other set of monads. Thinking through the details of spatial exclusion, however, drew attention to Leibniz's proposed equivalence between the order of space and the order of co-existence and suggested unappreciated affinities between the packing and cosmological interpretations. If the present paper is on the right track, both interpretations may be seen as tracing out the implications – within the complexities of Leibniz's philosophical system – of the once common thought that if God is to create a substance, he must create it *somewhere*.[38]

[1] Leibniz's works are cited here and throughout by abbreviations, first to an original language edition, and then, where possible, to an English language translation. The following abbreviations supplement those listed in the front of this volume: *Alexander* = H. G. Alexander

(ed.), *The Leibniz-Clark Correspondence* (Manchester: Manchester University Press, 1956); DSR = G. H. R. Parkinson (ed. and trans.), *De Summa Rerum. Metaphysical Papers, 1675-1676* (New Haven: Yale University Press, 2005); C = L. Couturat (ed.), *Opuscules et fragments inédits de Leibniz* (Paris: Presses Universitaires de France, 1903); Dutens = Ludovici Dutens (ed.), *G.W. Leibniz, Opera Omnia*, Volume 5 (New York: Georg Olms Verlag, 1989); H = E. M. Huggard (trans.), *Theodicy* (LaSalle: Open Court, 1985); LDB = Brandon C. Look and Donald Rutherford (ed. and trans.), *The Leibniz-Des Bosses Correspondence* (New Haven: Yale University Press, 2007); LOC = R. T. W. Arthur (ed. and trans.), *The Labyrinth of the Continuum: Writings on the Continuum Problem, 1672-1686* (New Haven: Yale University Press, 2001); LA = H. T. Mason (ed. and trans.), *The Leibniz-Arnauld Correspondence* (Manchester University Press, 1956); MP = G.H.R. Parkinson with Mary Morris (eds. and trans.), *G.W. Leibniz. Philosophical Writings* (London: Dent, 1997); NS = R.S. Woolhouse and Richard Franks (eds. and trans.) *Leibniz's 'New System' and Associated Contemporary Texts* (Oxford University Press, 2006); RM = Mary Morris and G. H. R. Parkinson (eds. and trans.) *A Résumé of Metaphysics* (London: J M Dent and Sons Ltd, 1973), 145-147, cited by section number.

[2] See, Jeffrey K. McDonough, 'Leibniz and the Puzzle of Incompossibility: The Packing Strategy', ['The Packing Strategy'] *The Philosophical Review* 119:2 (2010), 135-163. More standard interpretations of Leibniz's views on incompossibility have generally fallen into two rival camps. For presentations falling roughly into the 'logical' camp, see Jaakko Hintikka, 'Leibniz on Plentitude, Relations, and the "Reign of Law"', in Harry G. Frankfurt, (ed.), *Leibniz: A Collection of Critical Essays* (Garden City, NY: Doubleday, 1972), 155-190; Benson Mates, *The Philosophy of Leibniz: Metaphysics and Philosophy of Language* [*Leibniz*] (New York: Oxford University Press, 1986); Nicholas Rescher, *Leibniz: An Introduction to His Philosophy*

[*Leibniz*] (Lanham, MD: University Press of America, 1986). For presentations falling roughly into the 'lawful' camp, see Bertrand Russell, *A Critical Exposition of the Philosophy of Leibniz, 2nd edition* (London: George Allen and Unwin, 1937; reprinted London: Routledge, 1997); Ian Hacking, 'A Leibnizian Theory of Truth,' in Michael Hooker, (ed.), *Leibniz: Critical and Interpretative Essays* (Minneapolis: University of Minnesota Press, 1982); Gregory Brown, 'Compossibility, Harmony, and Perfection in Leibniz', *Philosophical Review* 96 (1987), 172-203; Jan Cover and John O'Leary-Hawthorne, *Substance and Individuation in Leibniz* [*Substance and Individuation]* (Cambridge: Cambridge University Press, 1999). For recent discussion and the current state of debate, see the introduction and essays in Gregory Brown and Yual Chiek, *Leibniz on Compossibility and Possible W*orlds (Switzerland: Springer, 2016).

[3] The game Leibniz has in mind here is most likely a variation on a game variously referred to as '*Nonnenspiel*,' '*Einsiedlerspiel*,' 'peg solitaire,' and simply 'solitaire.' In standard versions, the player starts with an array of markers (or pegs). The aim of the game is to remove as many markers as possible following the rules of the game that allow a marker to be removed once it is 'jumped' by another marker. In a letter to Pierre Rémond de Montmort of 17 January 1716, Leibniz commends an inverse version of the game that seems to be original with Leibniz. In Leibniz's version, the player starts with a single marker (or peg) (Dutens 28-29). The aim of the game is to fill the board with markers by following inverse rules of the original game, that is, by adding a marker when an empty place has been 'jumped.' It is possible to prove that the two games – the original solitaire and Leibniz's version – are mathematically equivalent, but interestingly only Leibniz's version works as an analogy for his understanding of creation and incompossibility. For discussion, see Wilhelm Ahrens, *Mathematische Unterhaltungen und Spiele* (Leipzig: B.G. Teubner, 1901), 94-113, and especially page 96; and Elwyn Berlekamp,

John Conway, and Richard Guy, *Winning Ways for Your Mathematical Plays, Second Edition, Volume 4* (Wellesley, Massachusetts: A. K. Peters, 2001), 803-841, and especially page 817.

[4] To keep things manageable, I will follow Leibniz's lead in focusing on space rather than time, and pretend that the lessons learned there can be unproblematically transferred to the temporal case. For a recent discussion of the role of time in Leibniz's thinking about incompossibility, see Ohad Nachtomy, 'On the Source of Incompossibility in Leibniz's Paris Notes and Some Remarks on Time and Space as Packing Constraints,' in Gregory Brown and Yual Chiek (eds.), *Leibniz on Compossibility and Possible W*orlds (Switzerland: Springer, 2016), 21-36.

[5] McDonough, 'Packing Strategy', 147-151.

[6] The literature on Leibniz's views on corporeal substances is vast. Pauline Phemister is notable for having argued that Leibniz is committed exclusively to corporeal substances throughout his career, see her *Leibniz and the Natural World* (Dordrecht: Springer, 2005). Daniel Garber and Samuel Levey both imply that Leibniz's shift to a monadic metaphysics is philosophically problematic. See, Daniel Garber, *Enchanting the World: Leibniz on Body, Substance and Monad* (Oxford: Oxford University Press, 2009); and Samuel Levey, 'On Unity and Simple Substance in Leibniz', *The Leibniz Review* 17 (2007), 61-106; Samuel Levey, 'Why Simples? A Reply to Donald Rutherford', *The Leibniz Review* 18 (2008), 225-248. For interpretations more sympathetic to both the endurance and coherence of Leibniz's monadic metaphysics, see: Robert Adams, *Leibniz: Determinist, Theist, Idealist* [*Leibniz*] (Oxford: Oxford University Press, 1994); Donald Rutherford, 'Leibniz as Idealist', *Oxford Studies in Early Modern Philosophy* 4 (2008), 141-190; Donald Rutherford, "Unity, Reality and Simple Substance: A Reply to Samuel Levey," *The Leibniz Review* 18 (2008), 207-224. My own views on Leibniz's understanding of

substance are set out in: Jeffrey K. McDonough, 'Leibniz's Conciliatory Account of Substance', ['Conciliatory Account'] *The Philosopher's Imprint* 13:6 (2013), 1-23.

[7] McDonough, 'Packing Strategy', 151-160.

[8] For cosmological interpretations of Leibniz's views on compossibility, see Donald Rutherford, *Leibniz and the Rational Order of Nature* [*Rational Order*] (Cambridge University Press, 1995), 181-88; Olli Koistinen and Arto Repo, 'Compossibility and Being in the Same World in Leibniz's Metaphysics', ['Compossibility'] *Studia Leibnitiana* 33 (1999), 196-214; James Messina and Donald Rutherford, 'Leibniz on Compossibility', ['Leibniz on Compossibility'] *Philosophy Compass* 4:1 (2009), 1–16; Donald Rutherford, 'The Actual World', ['The Actual World'] in Maria Rosa Antognazza (ed.), *The Oxford Handbook of Leibniz* (Oxford: Oxford University Press, 2018), 65-85.

[9] See, for example, Bertrand Russell, *A Critical Exposition of the Philosophy of Leibniz, 2nd edition* (London: George Allen and Unwin, 1937; reprinted London: Routledge, 1997), 118-126; Nicholas Rescher, *Leibniz*, 84-91; A.T. Winterborne "On the Metaphysics of Leibnizian Space and Time," ['Space and Time'] *Studies in History and Philosophy of Science* 13 (1982), 201–14.

[10] See, the subtle discussions by Adams, *Leibniz*, 250, 255;), Glenn Hartz and J. A. Cover, 'Are Monads Spatial?', *History of Philosophy Quarterly* 11:3 (1994), 295 – 316; Vincenzo De Risi, '*Analysis Situs*, the Foundations of Mathematics, and a Geometry of Space', ['*Analysis Situs*'] in Maria Rosa Antognazza (ed.), *The Oxford Handbook of Leibniz*, *Oxford Handbooks Online* (www.oxfordhandbooks.com) (Oxford University Press, 2018), paragraph 20. Michael Futch, *Leibniz's Metaphysics of Time and Space* [*Time and Space*] (Boston: Springer, 2008),152-160); Donald Rutherford, 'Leibniz and the Problem of Monadic Aggregation', *Archiv für Geschichte der Philosophie* 76 (1994), 66; *Rational Order*, 1995, 191, 251; 'Idealism Declined: Leibniz and

Christian Wolff,' ['Idealism Declined'] in Paul Lodge (ed.), *Leibniz and his Correspondents* (Cambridge: Cambridge University Press, 2004), 214-237, at 233.

[11] See, for example, R.T.W Arthur, *Leibniz* (Cambridge: Polity Press, 2014), 142; Stephen Puryear, 'Leibnizian Bodies: Phenomena, Aggregates of Monads, or Both?' *The Leibniz Review* 26 (2016), 99-126, at fn. 43; Tran (Jen) Nguyen, 'Leibniz on Place', ['Leibniz on Place'] *The Leibniz Review* 28 (2018), 43-66.

[12] My views on the spatiality of monads are partially set out in Jeffrey K. McDonough, 'Leibniz and the Foundations of Physics: The Later Years', ['Foundations'] *The Philosophical Review* 125:1 2016), 1-34, at 22-28. This paragraph and the next recap points made there.

[13] On the striking consensus of Leibniz's predecessors, see Robert Pasnau, *Metaphysical Themes: 1274-1671* (New York: Clarendon Press, 2011), 350-373. For a provocative argument that Leibniz differs from his immediate successors in the German tradition precisely on the question of the spatiality of monads, see Rutherford 'Idealism Declined'.

[14] For extended discussion, see R.T.W. Arthur 'Leibniz's Theory of Space,' ['Leibniz's Theory of Space'] *Foundations of Science* 18 (2013), 499-528.

[15] McDonough, ''Conciliatory Account'; 'Foundations'.

[16] I focus here only on those aspects of Leibniz's views on space that are relevant to the current discussion. For more thorough discussions of Leibniz's views on space, see, for starters, Arthur, 'Leibniz's Theory of Space', 142-165;), C.D. Broad, 'Leibniz's Last Controversy with the Newtonians', in R.S. Woolhouse (ed.), *Leibniz: Metaphysics and Philosophy of Science* (Oxford: Oxford University Press, 1981), 157-174; De Risi, '*Analysis Situs*'; Vincenzo De Risi, *Geometry and Monadology: Leibniz's Analysis Situs and Philosophy of Space,* [*Geometry and Monadology*] (Basel: Birkhäuser, 2007); Futch, *Time and Space*; 2008; Glenn Hartz and J. A.

Cover, 'Space and Time in the Leibnizian Metaphysic', *Noûs* 22 (1988) 493–519; Donald Rutherford, "Leibniz on the Ideality of Space," ['Ideality of Space'] in Brandon Look (ed.), *From Leibniz to Kant: New Essays* (Oxford: Oxford University Press, forthcoming); Ezio Vailati, *Leibniz and Clarke: A Study of Their Correspondence* (New York: Oxford University Press, 1997); Winterborne, 'Space and Time'.

[17] De Risi, '*Analysis Situs*', paragraph 6. For extended discussion of Leibniz's *Analysis Situs*, see De Risi, *Geometry and Monadology*. See also R.T.W. Arthur, 'Leibniz's Theory of Space'. For a guide to locating the relevant primary texts, see De Risi '*Analysis Situs*', footnote 3.

[18] See, for example, David Malement, *Topics in the Foundations of General Relativity and Newtonian Gravitation Theory* (Chicago: University of Chicago Press, 2012). Indeed, Leibniz sometimes speaks (incautiously, I think, but given a technical understanding of "point," not inconsistently) of points (rather than *situs*) as being the relata of spatial relations. For texts and discussion, see De Risi, *Geometry*, 173-174).

[19] For Leibniz's 'logicist' program in geometry, see A 2.1.351 (=A 3.1.14); A 2.1.769-71; A 2.2.490-491; A 3.7.113, A 6.4.165; A 6.4.703-705; A 6.4.969-70. See also '*Uniformis locus*', LH XXXV, 1, 14, bl. 23-24, available in English translation in Vincenzo De Risi, 'Leibniz on Geometry: Two Unpublished Texts with Translation and Commentary', *Leibniz Review* 15 (2005), 141-151. For helpful discussion, see Louis Couturat, La Logique de Leibniz (Paris : Félix Alcan, 1901); De Risi, '*Analysis Situs*', 5f ; De Risi, *Geometry and Monadology*, 178-264; Massimo Mugnai, 'Leibniz's Ontology of Relations : A Last Word?' ['Leibniz's Ontology of Relations'], *Oxford Studies in Early Modern Philosophy* 6 (2010), 171-208.

[20] De Risi, '*Analysis Situs*', paragraph 5.

[21] On the distinction between ideal space and (what I'm calling) "well-founded, concrete spatial relations," see Leibniz's *Fifth Letter to Clarke*, sections 27 and 47 (G 7:395/Alexander 63, G 7: 400-402/Alexander 69-72). For helpful, extended discussion of this distinction, see Arthur, 'Leibniz's Theory of Space'. Because he thinks that relations cannot inhere in two subjects at once, Leibniz maintains that truths about relations must be partially grounded in a perceiving intellect (see G 2:517/LDC 327, G 7:401/AG: 339). This idealist thread in Leibniz's thinking about relations is not, I think, important to our present concerns so I set it aside here.

[22] See, for example, A 6.4.1645, G 2:240/LDV 239, G 7:321-2/L 365. For discussion, see Jeffrey K. McDonough, 'Leibniz, Spinoza and an Alleged Dilemma for Rationalists,' *Ergo* 2:15 (2015), 367-392; Jan Cover and John O'Leary-Hawthorne, *Substance and Individuation;* Mark Kulstad, "A Closer Look at Leibniz's Alleged Reduction of Relations," *Southern Journal of Philosophy* 18 (1980), 417-432; Massimo Mugnai, *Leibniz's Theory of Relations* (Stuttgart: Franz Steiner Verlag, 1992); Mugnai, 'Leibniz's Ontology of Relations'.

[23] For an alternative reading of this passage, see Nguyen, 'Leibniz on Place'.

[24] See, for example, Saint Thomas Aquinas, *The Summa Theologica of St. Thomas Aquinas, Volume 1*, trans. Fathers of the English Dominican Province (Notre Dame, IN: Ave Maria Press, 1948), 269 [Pt. 1, Q.53, article 3]

[25] For texts and extensive discussion of Leibniz's Principle of Identity of Indiscernibles, see Gonzalo Rodriguez-Pereyra, *Leibniz's Principle of Identity of Indiscernibles* (New York: Oxford University Press, 2014).

[26] I've put this example in particular and several to come in diachronic terms for ease of expression and conception. I trust that the reader will recognize that the incompossibility

relations they consider in no way turn on one set of monads being actually created before another set.

[27] For a nice introduction to Hilbert's Hotel see George Gamow, *One Two Three … Infinity: Facts and Speculations of Science* (New York: Dover, 1998), 17-18.

[28] Olli Koistinen and Arto Repo 'Compossibility', 213-214.

[29] Although see Leibniz's remarkable, but speculative, thoughts on whether there might be dimensions between a surface and a solid (GM 5: 187-188). For discussion of those thoughts see, Samuel Levey, 'The Interval of Motion in Leibniz's Pacidius Philalethi', *Noûs* 37:3 (2003) 371-416, at 399-400; Samuel Levey, 'The continuum, the infinitely small, and the law of continuity in Leibniz,' in Stewart Shapiro and Geoffrey Hellman (eds.), *The History of Continuity* (Oxford: Oxford University Press, forthcoming).

[30] Contemporary philosophers who find themselves unsympathetic to this first, admittedly blunt, line of thought might compare David Lewis's treatment of the term 'actual' in, for example, David Lewis, *Philosophical Papers, Volume 1* (New York: Oxford University Press, 1983), 18-20; David Lewis, *On the Plurality of Worlds* (New York: Basil Blackwell, 1986), 92-96.

[31] For a nuanced discussion of Leibniz's equivalence between co-spatiality and co-existence that may bear on his understanding of compossibility, see Rutherford 'Ideality of Space'.

[32] Leibniz explicitly makes an exception to his equivalence for God and ideas (presumably understood to be in the divine intellect). See G 7:409/Alexander 81. This is particularly noteworthy since such an exception would not have been a foregone conclusion in Leibniz's time and earlier. See, for example, Isaac Newton, *Newton: Philosophical Writings*, ed. Andrew Janiak (Cambridge: Cambridge University Press, 2004), 25.

[33] See, for example, Rescher, *Leibniz*, 58-59; Mates, *Leibniz*, 75-77.

[34] Messina and Rutherford, 'Leibniz on Compossibility', 970-972.

[35] Messina and Rutherford, 'Leibniz on Compossibility', 972

[36] Messina and Rutherford, 'Leibniz on Compossibility', 973

[37] Donald Rutherford has recently proposed that Leibniz's God is precluded from creating more than a world because a creation that failed to be a world would also "fail to form a suitable object of God's will" (2018, 74). For development of this intriguing suggestion in context, see his (2018). As I read Leibniz, Rutherford's response – even if it were successful – would still leave Leibniz open to the second worry sketched in this section.

[38] Earlier versions of this paper were presented at The Tahoe Early Modern Workshop and the annual meeting of the Leibniz Society of North America. I am grateful for discussion with attendees at both of those events. I owe special thanks to Samuel Levey and Donald Rutherford for their careful, thoughtful and challenging questions on earlier drafts of this paper.