Plenitude and Compossibility in Leibniz

Catherine Wilson, University of British Columbia

Abstract

Leibniz entertained the idea that, as a set of "striving possibles" competes for exist-ence, the largest and most perfect world comes into being. The paper proposes 8 criteria for a Leibniz-world. It argues that a) there is no algorithm e.g., one involving pairwise compossibility-testing that can produce even possible Leibniz-worlds; b) individual substances presuppose completed worlds; c) the uniqueness of the actual world is a matter of theological preference, not an outcome of the assembly-process; and d) Goedel's theorem implies that there can be no algorithm for producing optimal worlds, assuming an optimal world contains truth-discerning creatures, though this is not to say that such worlds cannot arise naturally.

1. Introduction

How does a set of Leibnizian possible substances project into the actual world? The world we experience and act upon is just such a projection. From a set of possible entities, possible worlds come into being, and from a set of possible worlds, the actual world comes into being. Interperceiving substances make it the case that a phenomenal world appears, and that they appear to each other. It is famously unclear how substances or monads ground or project into spatio-temporally located extended bodies or corporeal substances. But the subject of this paper is an earlier moment of world-making that is equally puzzling. How do possible substances give rise to possible worlds? How does one of the worlds become the actual world?

It is not easy to piece together from Leibniz's few passages on the ultimate origin of things how the world comes to be. He seems to need considerable help by way of what is termed rational reconstruction, and we might begin by listing eight theses, each of which he appears to hold:

(1) A given substance exists in only one world.

(2) Our world is the richest and fullest of all possible worlds.

(3) Our world does not contain every possible substance.

(4) If and only if substances A …..n can (all) exist together in some possible world, they are compossible.

(5) Substances A…n are compossible if and only if each perceptually represents (all) the others.

(6) If A …n are compossible, and if any element of that set is compossible with any member of the compossible set B ….k, then A,B…n…k are (all) compossible and conversely.

(7) Our world is morally-aesthetically optimal.

(8) Our world is the only actual world.

I think that it is possible to produce an account of how Leibniz could have conceived the creation of possible worlds, and of the actual world, from substances that satisfies theses (1)-(7) (with a few emendations and limitations), and that the account is by no means inconsistent with (8). But even on the most satisfactory account, there are some curious features. First, simple combinatorial mechanisms cannot take substances into worlds unless fully coherent worlds exist as multi-dimensional images or ideas in the mind of God before world-assembly begins. Second, (8), which is of course independent of the other theses, turns out to be a surprisingly troublesome proposition.

8) says that there are no actual worlds other than ours. And most Leibniz scholars are agreed that everything that really exists is compossible with everything else that really exists, and that there is a uniquely actual world that is the totality of those things, and that Leibniz himself held this correct view. They regard it as obvious there may be different planets, different galaxies, and even different universes, but everything, they believe, either belongs to the unique, actual world or is "merely" possible, i.e. non-existent. But there are alternative accounts of possibility and actuality, and some of them were believed in the 17th century. Its rivals include the idea that there are no merely possible objects or worlds, because everything possible exists and happens in our world, and the very different idea that there are many other actual worlds besides the one we inhabit.[1] The claim that there is only one actual world is *not* a tautology. A person can state emphatically "The world is all that is the case!" or "What I mean by 'the world' is….the totality of what is!" But there is no contradiction in supposing that, in a number of actual worlds that are not ours, actual thinking creatures are having these thoughts about their worlds. And anyone who tries to give a cosmological theory about how our world comes into being from a state of potentiality or possibility may very well find herself faced with our problem: namely, how can she be sure that the generative procedure doesn't fill up our world with all possible entities or produce many actual worlds besides ours?

Historically, theistic creationists have been concerned to maintain the uniqueness of the actual amongst a plentitude of possibilities, because of the importance they assign to the species *homo sapiens* and to the actions of particular nameable

agents of the species. God's power is revealed for them in the production of possible worlds, not actual ones. Leibniz, one such theist, does seem to think it important that our world, the whole of which we all perceive, is uniquely actual, and he finds the thesis of the plurality of actual worlds morally and theologically objectionable. The uniqueness of our world seems to be tied up conceptually with its being the best. But I will try to show that worries about (8) are profitable both historically and philosophically. For Leibniz was engaged, not only with the Epicurean thesis that the world is self-creating and yet orderly, but also with the Epicurean thesis that there is a plurality of actual worlds. The first thesis does not logically imply the second, but the story one tells to explain why the first is true makes room for the second. A blanket condemnation of other real worlds is, I will argue, insufficiently motivated by Leibniz's concerns, especially his concern with plenitude. This is not to say that the historical Leibniz would have denied that he was fully committed to the truth of (8), though some of his remarks might make us wonder if he occasionally forgot this fact about himself. It is to say that he could have discarded (8) and extended the list of theses above to include certain propositions about the totality of actual worlds with little harm and much benefit to his main metaphysical proposals.

Leibniz seems to have intended his "metaphysical mechanism" as a function that would take individual substances, rather than Epicurean atoms, as input, combine them, and give our world as its output, or as an algorithm whose recursive operations would gradually build a world out of compossible substances. But how does he escape the objection, so often put to the atomists, that mechanical processes mostly give rise to messy and perhaps awful worlds? The answer is that he can't, unless the workings of the metaphysical mechanism are complemented by the intuitive choice of a Mind, and unless ideas of worlds logically precede substances.[2] Goedel's theorem implies that the only way, other than sheer good luck, to get an optimal world out of a collection of compossible substances is for an idea of the world to precede the creation of the substances and for its excellence to be directly perceived. So, we can know about our world that either it is morally-aesthetically optimal and was specially selected by God, or it is the result of a blind mechanical process and is not optimal, or it is the result of a blind mechanical process and is optimal. But we can be sure that even God could not write out the algorithm for the optimal world. What, then, does the metaphysical mechanism that combines substances actually do? My argument will suggest that it is good for producing other worlds, including other actual worlds.

2. Three models for the coming-to-be-of worlds.

In the *Ultimate Origination of Things* of 1697 Leibniz describes a "Divine Mathematics or Metaphysical Mechanism" that brings the world into existence through the striving of possibles to attain actuality. "[I]t is obvious," he says, "that of the infinite combinations of possibilities and possible series, the one that exists is the one through which the most essence or possibility is brought into existence."[3] For… "all possibles… strive with equal right for existence in proportion to the amount of essence or reality or the degree of perfection they contain."[4]

The idea that quantity of essence determines existence was present more than twenty years earlier:

> After due consideration I take as a principle the harmony of things: that is, that the greatest amount of essence that can exist, does exist. It follows that there is more reason for existing than for not existing, and that all things will exist, if that can come about. For since something exists, and all possibles cannot exist, it follows that those things exist that contain the most essence, for there is no other reason for choosing some and excluding the rest. …
>
> It follows from this principle that there is no vacuum among forms….[5]

There is a trouble spot in Leibniz's thinking in April 1676, as it is represented here. If not all possibles can exist, it seems that there must be a vacuum among forms. If possibles like flying pigs can't exist, there is a vacuum of forms where the flying pig could have been. And in fact Leibniz became aware of this contradiction quite soon. Indeed, by December 1676, he had decided to admit the vacuum of forms:

> It is not superfluous to discuss the vacuum of forms, so that it can be shown that not all things which are possible *per se* can exist together with other things. For otherwise there will be many absurdities; nothing can exist which is not so absurd that it does not exist in the world—not only monsters, but also evil and miserable minds, and also injustices, and there would be no reason why God should be called good rather than evil, and just rather than unjust.[6]
>
> One must certainly hold that not all possibles attain existence, otherwise one could imagine no novel that did not exist in some place and at some time. Indeed, it does not seem possible for all possible things to exist, since they get in each other's way.[7]

Leibniz had apparently discovered that the notion of "compossibility" or "being able to exist together with something else and not getting in its way" could help

him to configure the world in a morally and aesthetically sound way. How two substances might be incompossible when they do not interact and are not defined by negations of each other is a well-known problem, but we can agree to pass over it, as Leibniz did, for the sake of the argument.[8] We just have to suppose that, like certain combinations of elementary particles in physics, some pairs of substances can't exist together

The creation-story is normally taken as follows. In the beginning, there is nothing except God, the Necessary Being, and an infinite number of possible entities—possible substances—about whom that God thinks, as we might think of a substance such as a person or an animal, only in full (infinite!) depth and comprehensiveness. Where we can only think of a few substances at a time, God can think of (an infinity of!) them all simultaneously. From this infinity of divinely-imagined possible individuals, the actual world emerges by a selection or self-selection process, for the world is nothing over and above a collection of individual substances. Possible worlds have to come to be before the actual world can come to be. Many commentators have worried about whether all this takes place with God a passive observer of the actualization of the best possible world or whether God actively composes, compares, and chooses.[9] But the question that should concern us first is precisely how such a process can occur inside or outside God's mind so that Leibniz succeeds in avoiding the dreaded Spinozistic conclusion that *everything possible exists* since there is no reason for anything not to exist if it is not impossible.

There are a number of ways not to understand this process because they are inconsistent with one or more of the theses enunciated above. Here is an example:

The combinatorial model

In order to create the actual world, God generates in his mind an infinite set consisting of the all the 1-tuples, all the 2-tuples, all the 3-tuples, and so on of possible substances. Call this huge set the combinatorial manifold. The combinatorial manifold just is the set of all possible worlds. These sets all become entrants in the heavy worlds-competition. The largest world that does not contain all possible objects attains being.

This procedure will not work; its output will satisfy few of the listed theses. Compossibility—the feature by which possibles somehow prevent other possibles from attaining actuality—has no role to play in the account. And it seems that if we took the set consisting of all possible substances (however this is to be understood) and merely removed *one substance* to satisfy (3) ("Our world does not

contain every possible substance"), we would have the best possible world in terms of quantity of realized essence. For we would now have a world that did not contain all possible substances, but that was the fullest and richest world otherwise. This seems contrary to Leibniz's intentions. For which one should we remove? And anyway, removing only one would leave many monsters and absurdities; we would have the Spinozistic horror minus one, which is not a great improvement.

Perhaps, it will be argued, God evaluates all the sets when they are constituted and chooses the one that projects into the most beautiful, orderly, simplest, richest world, in accord with His pre-existing moral-aesthetic criteria to satisfy (7). Probably, He'll need to remove more than just one object from the heaviest set to get a morally-aesthetically optimal world. But we then give up the idea that there is a mechanical procedure by which a good world can assemble itself, or by means of which the excellence of a world propels it into existence by something analogous to weight.

Moreover, the combinatorial model does not respect thesis (1) ("A given substance exists in only one world"). For objects that exist in our world exist as well in numerous merely possible worlds. A given substance would exist in a 1-world by itself, in a set of 2-worlds with other single substances, in a set of 3-worlds, and so on.

But suppose that not all substances will "go together." Some 2-tuples are impossible to form: the two substances just will not stick because they are not compossible. And suppose that in forming possible worlds, God can take each object only once. This suggests the following model for world-composition:

The compossibility-checking model

God employs the following procedure: He begins by thinking of all possible substances A….n, for although they cannot all exist together they can all be thought together. He then concentrates His attention on substance A and runs though the whole (infinite) series of possible substances B…n to filter substances compossible with A, which He puts together with A into a possible world. From the discard pile of substances incompossible with A, He picks another substance, and runs through the whole remaining pile. When each substance has been placed into one world, He surveys the worlds and brings the largest and fullest into existence. All this happens in an instant.[10]

There is nevertheless a problem with this procedure. Suppose A happens to be the possible substance Julius Caesar, and the next substance God picks up to compossibility-test is Judas. We know *a posteriori* that Judas is compossible

with Caesar, for both exist in our actual world. But is there a possible world consisting of the 2-tuple {Caesar, Judas}? There cannot be: for if Judas and Caesar exist in our world, they cannot exist in some other world too by (1). What prevents Judas and Caesar from forming a possible world "prematurely" if they are compossible? We should not succumb to the temptation of rewriting (4) as a conditional, for it is in fact true that if two substances are compossible they are found together in a possible world.

The premature assembly of tiny worlds of compossible objects needs to be precluded by the account we give. (The assertion that world-assembly happens in an instant does not help us here: why don't Judas and Caesar instantaneously form a world?) And such assembly violates (5) as well as (1). For both Caesar and Judas perceive many objects that would not exist in the tiny duplex-world {Caesar, Judas}. Caesar perceives Vercingetorix, for example. But then Vercingetorix must be compossible with Caesar and he belongs in Caesar's world. Of course we could persuade Leibniz to scrap (5), about which he appears to have mixed feelings. Every substance is confusedly omniscient and perceives every other substance, but Leibniz also claims that none of my phenomena would be different if I were the only substance in the world along with God.[11] If what I call "the world" is the duplex world {CW,God}, I will still perceive the robin on the lawn, but it will not perceive me, contrary to (5), for there is no robin in my world. But I am inclined to think that Leibniz would reject this idea and stick with (5), even if it meant he had to give up recourse to a fine image—the soul alone with God experiencing a world through God's omnipotence, much as Descartes imagines himself alone in a world with a *malin genie*.[12]

So for the "mechanical" procedure to work, some modification needs to be introduced so that parts of possible worlds are not possible worlds. Such collections as {Judas,Caesar} or {Adam,Judas,Caesar} or {Adam,Judas,Caesar,CW} can only be torn-off pieces of worlds, fragments of worlds that have fallen apart, or potential parts of possible worlds. They are not even (unpromising) entrants in the competition to be the richest and fullest and otherwise best world.

Suppose we tried to prevent such fragments from counting as possible worlds by modifying (6) to read:

 (6a) If A …n are compossible, and if any element of that set is compossible with any member of the compossible set B ….k, then A,B…n…k are all compossible, *but not conversely*.

The one-way entailment in (6a) means that even when all the members of a large set are compossible, it is not the case that any of its subsets are compossible.

While it does seem to be true that compossibility is a property with some "holistic" implications, 7a) is so counterintuitive as not to be worth considering. The compossibility-checking model nevertheless seems to be on the right track, so let us pursue it a bit further, leaving the problem of "world fragments" aside for a moment and concentrating on its other perhaps remediable inadequacies.

A problem with this model is that it does not show us how compossibility functions to keep the actual world "trim," by preventing substances combining with each other into messy, incoherent or morally bad worlds, while at the same time guaranteeing that the assembled world is very large. Selection and plenitude are competing principles. The world must manifest both God's wisdom in pruning out entities and his generosity in including them. Any procedure that prunes out effectively tends to reduce plenitude. Any procedure that guarantees plenitude tends to reduce selection. Perhaps when God sorts through all the substances, he finds that they are *mostly* all compossible and that the world contains *nearly* everything—nearly every absurdity, immorality, and frivolity. The world might look very good from our perspective, but all the absurdities could be taking place in distant corners of our universe where we perceive them (as (5) requires) but we do not perceive them distinctly enough to be clearly aware of them.[13] Or perhaps when God sorts through the possibles, he finds that they mostly do not go together. Indeed, it is more probable that my world is a medium-sized set relative to the largest sets of the combinatorial manifold than that it is either a very large or a very small world, for there are more distinct medium-sized worlds.[14] It is clear why compossibility-checking makes our world is as large as it can be—no additional substance will fit in it. But it does not show us what makes it a large world.

Of course, the commentator can resort to the dogmatic claim that Leibniz's teaching just is this: the world is constructed purely through the selective action of compossibility on the combinatorial manifold, and further moral-aesthetic choices by God, and *yet* very large. Somehow, against all probabilities, a large world has made it across the border from possibility to actuality, just as huge meteors sometimes reach us from space. But in the absence of further explanation this is a most unLeibnizian thought.

The puzzle-piece model

Returning to the problem of premature assembly, we saw the need for some explanation for why the metaphysical mechanism does not put together worlds like {Judas, Caesar} when these substances are compossible. The ideal account should show us why, in the absence of an appropriate quorum of other compossibles, two

compossibles do not stick together in a world-like way.

Leibniz occasionally suggests that the actual world is already given as a certain "space." Perhaps the problem solved by the "striving possibles" is not how to agglomerate, but how to fill in a given outline with pieces so that there are no gaps. This idea is expressed in Leibniz's comparison between creation and the solution of a building or tiling-problem. The receptivity or capacity of the world is, he says, like the plot of ground upon which a building is to be built or like a board game:

> …in which all the pieces on the board are supposed to be filled in accordance with certain rules, where at the end, blocked by certain spaces, you will be forced to leave more places empty than you could have or wanted to, unless you use some trick. …. And so, assuming that at some time being is to prevail over nonbeing, or that there is a reason why something rather than nothing is to exist, or that something is to pass from possibility to actuality…it follows that there would be as much as there possibly can be, given the capacity of time and space…; in a word, it is just like the tiles laid down so as to contain as many as possible in a given area.[15]

Although Leibniz refers here to only one single outline that has to be filled, we could understand substances as like tiles or puzzle pieces, each one of which has its own shape, and possible worlds as so many differently shaped plots or regions of logical space that can be filled in with different collections of puzzle-pieces.[16] Each piece can be used only once. The world we live in is the world that is projected by the pieces that fill the largest and most beautiful (whether we understand this as the largest of the set of most beautiful puzzles, or the most beautiful of the set of largest puzzles) of the puzzles that can be completed with no gaps. Reading "compossibility" as "having edges that fit together" and reading "existing together in a possible world" as "being part of the same completed puzzle," the model would explain how it is that:

(1) A given substance can exist in only one possible world.

(2) Our world is the richest and fullest of all possible worlds.

(3) Our world does not contain every possible substance.

(4) If and only if substances A …..n can (all) exist together in some possible world, they are compossible.

(6) If A …n are compossible, and if any element of that set is compossible with any member of the compossible set B ….k, then A,B…n…k are (all) compossible and conversely

(7) Our world is morally-aesthetically optimal.

There is no clause in the puzzle-piece model that supports the interperception thesis (5). However, nothing in it is inconsistent with (5). It is after all just a model and does not need to account for every aspect of the phenomenon being modelled so long as it is not in conflict. The problem of tiny, premature worlds does not arise. Pieces like Judas and Caesar must have two edges that fit together, but if they are not parts of the same completed puzzle, they are not members of the same possible world.

   A drawback of the model is that we seem to have lost the self-assembly feature. But to build in the Epicurean element, we need only imagine the puzzle-pieces twisting and jostling amongst themselves and drifting from frame to frame in logical space until all the puzzle frames are filled. Nevertheless, our world, and every possible world, is in a sense, given in advance. To make a puzzle, we start with a photograph or drawing, glue it to a backing and then cut it up with a jigsaw. And this, I submit, is what Leibniz's theory of the striving possibles comes to. The notion of a "world" conceptually precedes the notion of a substance, even though ontologically substances precede worlds in the sense that their states and strivings project the phenomena we experience. What then is a world?

3. Worlds are such that there must be many of them

A Leibnizian world is…the sort of thing we see around us. It is a "place" in which things appear to subjects and in which subjects can act and know. Or it is a collection of appearances. There are stabilities and regularities, also unexpected events in worlds. To say that there are "other worlds" is to say that there is or could be something like *this* that I could never experience, act in, or come to know. In short, if we had no idea what a world was, we could have no idea what a substance was. This "worlds-first" starting point is subtly expressed in a well-known passage in the *Discourse,* describing the creation of the actual world:

> God, so to speak, turns on all sides and in all ways the system of phenomena which he finds it good to produce in order to manifest his glory, and he views all the faces of the world in all ways possible, since there is no relation that escapes his omniscience. The result of each view of the universe, as seen from a certain position, is a substance which expresses the universe in conformity with this view, should God see fit to render his thought actual and to produce this substance.[17]

But why should we think—in view of Leibniz's tiling-analogy—that there are other possible worlds, other filled-in outlines, that are complete systems of phe-

nomena like ours? Perhaps there is only one world, one outline needing to be filled in with possibles, and beyond it only a number of "leftover" possible substances or collections of possible substances. This eventuality is ruled out by (4)-(7). If a possible substance perceives, it perceives at least one other substance, and that substance is a denizen of its world; the existence of a possible substance implies the existence of a fully articulated possible world. Tiny duplex- and triplex-worlds are possible, but if other possible substances resemble us, their worlds will tend to be much larger than this.

In describing substances as *results* of views Leibniz expresses the idea that a substance simply instantiates a possible perspective on something pre-existing—a "system of phenomena." God begins with a phenomenal world—the sort of thing that we experiencers experience—and then he makes this airy spectacle solid and substantial by creating creatures to express various perspectives on it. To be sure, views are at the same time results of substances; what I perceive in my world is a function of the substances composing it. But the world as Leibniz conceives it must exist first in the mind of God who understands how its constituents function in combination. And he takes this holistic idea further: particles of matter can be conceived apart from the worlds they compose, but a perceiving-perceived Leibnizian substance can only be understood as a member of a possible world insofar as it expresses something outside itself. Another possible world would consist of another "system of phenomena" that could be expressed from various points of view. The substances that the metaphysical mechanism begins with are not, like the atoms of the Epicureans or the corpuscles of Descartes, entities whose existence does not presuppose the existence of a system of phenomena.

Other worlds could be richer or poorer in phenomena than ours. Consider, for example, a world quite like ours except that it does not contain any of the same individuals and has an extra moon, a larger population of sparrows, and a few more colours visible to humans. Or, consider the world that is rather like ours except that it has no moon and only one colour, red, in addition to black, white, and shades of grey. To understand the metaphysical mechanism, we have to begin with these alternative worlds in God's mind and the possible substances that express them (and that presumably "ground" their phenomena) and then explode them. We have to imagine them shattered, like atomic fragments of planets, and chaotically distributed through logical space. And now, puzzle-pieces that belong together have to find the way to each other. Wherever two that are destined to be in the same world encounter each other, they combine. Wherever two can take on

another piece from their world, they do so, and wherever three can take on a fourth they do so, and so on. But no assembly of pieces becomes a world until all its pieces have come together, whether this is to be understood as an instantaneous process, with every piece as it were rushing in no time at all through logical space to join its compossibles, or as happening sequentially.[18] Each world is as large as it can be, including our world, and each substance belongs to no more than one world. As with a puzzle, we cannot see from a consideration of the pieces before they are assembled what the finished world will look like. Whatever picture appears when the puzzle is complete represents the phenomenal world we get, and, taking into account size, beauty, and morality, God makes a final decision about which one is all-things-considered optimal. Such an account seems to preserve theses (1)-(7). But what about (8), the uniqueness thesis?

The metaphysical mechanism as we have reconstructed it does not generate one and only one actual world. The process seems to leave our world, at its conclusion, one of many worlds whose ontological status is equal: either they are all possible or they are all actual. (8) might seem easy to satisfy. Perhaps God looks at all the completed puzzles and actualizes the best puzzle, like a jury awarding First Prize. At that instant, its up-to-now merely possible individual substances become actual. The other completed puzzles remain as also-ran possible-worlds. Or, perhaps as soon as possible substances assemble into a world, they become actual, and then God demotes all the completed puzzles that are too small, too messy, too ridiculous, or too immoral to the status of merely possible worlds. But whether we conceive God as promoting one world from possibility to actuality or as demoting many actual worlds, this final step is problematic in terms of Leibniz's other metaphysical requirements. For the other worlds are, each and every one, as coherent as ours. Their puzzle-pieces all fit together just as well, and their perceivers are just as harmoniously related to one another as the perceivers in our world.

Let's take the two possibilities in turn. Suppose world-formation creates an initial plurality of actual worlds from substances and that amongst them is a pretty little world with simple laws and rich phenomena. It's a nice world, but e*x hypothesi*, God will de-actualize it if he has any bigger worlds with equally simple laws and equally rich phenomena. But for God to eliminate this world seems rather brutal, and if substances are naturally immortal, as Leibniz maintains, then God does not, or would not, or could not annihilate the now-actual constituents of this world. Can he tear these actual but subperfect worlds apart and leave their substances detached and worldless? (This would be like shaking out a completed

puzzle and throwing its pieces around the room.) We cannot penetrate very far behind the analogy,[19] but it would seem that world-demotion has to leave at least some possible worlds intact. For we know that Leibniz's system requires that there remain *some* merely possible worlds, considered as harmonious, coherent sets of nonactual phenomena to supply truth-conditions for contingently true statements like "Adam sinned" or "Caesar crossed the Rubicon."[20] (In some now merely possible but, for a moment, actual world, a diffident Caesar-like general, who fits in with the rest of the individuals of his world, refuses to cross the Rubicon.) Alternatively, we might suppose that God leaves the pretty little world intact but refuses to promote it to actuality. The general observation that Leibniz needs merely possible worlds to explain contingency does not, however, imply that his God has sufficient reason to demote *all* but one actual world to mere possibility or sufficient reason to promote *only* one. It cannot, I think, be a sufficient reason to demote or to fail to promote the pretty little world that it is needed in the realm of mere possibility for contingency-establishing purposes.

   Remember that since a world is defined as a set of interperceiving compossible substances, there is no logical contradiction in supposing that separate worlds of non-interperceiving substances can co-exist. The substances can be incompossible, while their worlds are compossible. Thesis (8) is, as we noted, independent of the other theses. And I think that, had Leibniz decided to reject (8) and simply to hold to (1)-(7), no serious harm would have been done to his metaphysics. For a plurality of anything is *prima facie* a good in Leibniz's system. If it is good to pack every corner of the world with substances, why isn't it good to pack Actuality with worlds, even if some of them are, taken as individual worlds, less good than ours? Our world contains substances we don't much "like," such as parasitic intestinal worms, and substances we do "like," such as gorgeous tropical birds. But they sum to an overall good. Why shouldn't Actuality contain worlds we wouldn't like if we knew about them as well as a world we do like, namely our own? The following situations seem to be parallel:

(a) A possible (small-w) world is an "outline" that is there to be filled in with compossible, mutually perceiving substances.

(b) The (large-W) World is an "outline" that is there to be filled in with all compossible, mutually non-interfering (small-w) worlds.

The thesis of plenitude (2) seems to have a higher-order correlate, the thesis that the (large-W) World must comprise a set of (small-w) worlds that consist, each of them, of discrete sets of compossible objects. It is intrinsic to this conception however that the (large-W) World cannot be construed as a set of compossible

objects, but only as a set of compossible (small-w) worlds. We could write its as (2'), limited by (3').

(2') The (large-w) World is the richest and fullest of all possible assemblies of (small-w) worlds.

(3') The (large-W) World does not contain all possible worlds.

We could even introduce higher-order versions of (4) and (5) on Leibniz's behalf:

(4') (small-w) worlds A...n are compossible if and only if they can all exist in the (large-W)World without impeding each other, and conversely.

(5') (small-w) worlds A..n are not incompossible if their substances cannot perceive one another.

It might be objected that a world with which we can have no communication and which we cannot perceive just is a possible world that is nonactual. But this is surely not a necessary truth. Why couldn't God create other worlds, just as real as this one where other sentient creatures looked around and marveled at everything, that we could just never perceive? Every (small-w) world is closed under perception and interaction, but why shouldn't God see or be present to worlds to which we have no access?

The defender of the centrality of (8) in Leibniz's thinking might insist that his God wishes to bestow on us a great honour, the honour of being substances in the only actual world. Or that God wishes to bestow on us the honour of perceiving everything that occurs in the World, in the whole realm of actuality. If God has bestowed on us either honour, then the World and the world are identical. But what good reason do we have for thinking that these two desires should take priority over His desire to maximize essence? Isn't it enough that we perceive everything that happens in the world, and that we are substances located in the best of all worlds in the World? The reader might at this point dig in his or her heels and insist that, although there is nothing illogical or even morally-theologically repugnant about the hypothesis that there is a plurality of actual worlds, it just *is* Leibniz's doctrine that only our world is actual, and he attaches tremendous importance to our world's uniqueness in this respect.

This is not the place to discuss or defend the historical claim that Leibniz's monadology contains traces of many-world Epicureanism, despite his official rejection. For my claim in this paper is neither about the historical Leibniz's endorsements, nor about the complications that ensue when a rejected doctrine remains buried deep in a metaphysics.[21] The claim here is simply that the puzzle-piece model is the most coherent account of his creation-story, preserving most of the theses he held dear, and that, on the puzzle-piece model, there is no reason

to resist the plurality of worlds. Leibniz would have appreciated that compossibility is a relation that can be defined not only on substances, but also, by extension, on worlds. But I cannot resist quoting one passage from the *Theodicy* where Leibniz is concerned to show that the majority of rational beings need not be damned even if most people on earth are:

> It seemed to the ancients that there was only one earth inhabited, and even of that men held the antipodes in dread: the remainder of the world was, according to them, a few shining globes and a few crystalline spheres. Today…it must be acknowledged that there is an infinite number of globes, as great or greater than ours, which have as much right as it to hold rational inhabitants, though it follows not at all that they are human. It is only one planet, that is to say one of the six principal satellites of our sun; and as all fixed stars are suns also, we see how small a thing our earth is in relation to visible things….[22]

We twentieth-century Leibnizians know that other planets and galaxies are part of our (small-w) world. We can perceive Mars and everything on it, according to the interperception thesis, though of course very, very faintly, from here; and all the living creatures on Mars—for the Martian rock must be full of them—can look back at us and perceive us, though very confusedly. So it is tempting to insist that Leibniz himself acknowledges that there can be many planets and even many solar systems but is little disposed to acknowledge many worlds. We may even pin on Leibniz the view that we have confusedly omniscient knowledge of everything that is happening on "the infinite number of globes as great or greater than ours." But the point of the passage is that the planets and celestial objects we can see we know to be only a small part of the whole. The plenitude of the World suggests that we are not, after all, perceptually related to the whole thing. In that case, other species might belong to the World, the realm of actuality, but not to our closed system of mutual perceivers, the world. They would not be merely possible. They would fill in taxonomic, perspectival, and even moral gaps. The birds and animals of those worlds would not be compossible with our birds and animals: if we tried to mix them together they would somehow impede each other. Just as tigers are not found wild in New York State, finite sinless rational beings are not found in the world. But our worlds and their world can be compossible. We can all exist in the same World, mutually ignorant of one another.

4. Goedel's theorem implies that a metaphysical mechanism cannot be described that will generate a morally-aesthetically optimal Leibniz-world.

There are three hypotheses relating the world's qualities to its origins:
(a) Our world is morally-aesthetically optimal and was specially selected by God.
(b) Our world is the result of a blind mechanical process and is not optimal.
(c) Our world is the result of a blind mechanical process and is optimal.
(I assume that the nature of God is such that if God specially selected our world it cannot fail to be morally-aesthetically optimal.)

Suppose we knew—somehow—that our world was morally-aesthetically optimal but did not know whether it was created or selected by a God or came into being "by chance" as the Epicureans maintain. Would we have any reason to prefer hypothesis a) to hypothesis c)? I think not, and much of the interest of Leibniz's theory of creation relates to his evident conviction that establishing philosophically the *quality* of the world is more important than establishing who or what created it. That is why he goes to the trouble of trying to describe—as far as he does— a metaphysical mechanism. God could use, or be, the mechanism, or the mechanism could even function in the absence of God. But the excellence of the world would be ensured. It is the world's *goodness* that for Leibniz is the source of our reverential attitudes and moral seriousness, not the fact that it was created by so-and-so or by such-and-such. I want therefore to concentrate on c). Could there be a metaphysical mechanism that would automatically select the best of all possible worlds without the need for God's intuitive judgement of what is best, or, what comes to the same thing, that would model God's creation or selection of a world?[23] By chance, such a mechanism could come into being. But no mechanical process can be described whose output can be guaranteed to produce truth-knowing or reality-perceiving creatures. And the presence in it of truth-knowing or reality-perceiving creatures would have to be a feature of a morally-aesthetically optimal world.

To see this, consider various generate-and-select procedures of a mechanical nature. The basic pattern is that used in probability-theory, where we generate all possible cases and then select the favorable ones. For instance, to calculate the probability of throwing a 7 with 2 tosses of a die, one can write down the 36 possible results and count the number of 7s obtained in various ways. Or, in "natural selection," members of a population can be conceived as mating at random, and afterwards certain gene-combinations are picked out for survival and reproduction. Compare the following tasks that might be accomplished by a be-

ing I will refer to as "the Calculator":

(I) The Calculator generates all possible sequences of 200 "moves" (including legal and illegal moves) by white then by black on a chessboard, then selects the sequences that are legitimate "games."

(II) The Calculator generates all possible combinations of notes played by 50 orchestral instruments simultaneously in 45 minutes, then selects the ones that are "symphonies."

(III) The Calculator generates combinations of spaces, letters and punctuation to fill 10^{1000} 100-page "books," then selects the ones that are a contribution to natural science.

(IV) The Calculator generates a set of possible worlds, then selects those in which there are humans who possess a knowledge of nature.

A divine Being could perform any one of these tasks. But which ones, we might wonder, could be performed purely mechanically? Task I is an ideal candidate. A machine can easily sort chess games from sets of "random" moves on a chessboard. Task II seems to require something more by way of musical taste and knowledge, but I think we should not rule it out that a cleverly designed program could pick out only those items that musically-educated hearers would accept as symphonies. A machine, however, according to Godel's theorem, cannot perform Task III, since there are truths in all systems as high or higher than first-order arithmetic that cannot be proved by employing an algorithm.

If Task III cannot be accomplished mechanically, neither can Task IV. For if no mechanical analysis of written propositions can decide their truth value, no mechanical analysis of mental states of creatures can decide whether they have true beliefs.

When God chooses the best of all possible worlds, or when he allows it to emerge in his mind, he is not choosing something like the longest chess game with the most moves, or the most voluminous set of written letters, or the musical piece that gets the most notes into the smallest space. An algorithm can do this. And perhaps an algorithm can even pick the most interesting game, and the most pleasing tune, in case there are unknown psychological rules that account for taste and select for beauty. But if God picks a world in which creatures are aware of how things are with them, he does something that a machine or a metaphysical mechanism cannot do.

Suppose we could be perfectly certain that we were in fact creatures who knew many truths. Could we conclude that our world could not have arisen as a result of a metaphysical mechanism, but only because God selected our world using his

taste, judgement, and truth-discerning abilities? Though many theists would per-haps like to make that inference, it does not work. A mechanical process such as natural selection can produce a world in which there exist truth-knowing crea-tures and even by sheer good luck a world that is morally-aesthetically optimal without having to be specially picked by a Mind that itself has a truth-discerning faculty. All of the excellent characteristics of our world—its beauty, harmony, the simplicity of its laws, the presence of truth-discerning creatures in it—are consistent with the existence of a blind metaphysical mechanism. All that is ruled out is that we (or God) could write down the formula for a mechanism that would be guaranteed to produce this outcome.

Received 22 July 2000

Catherine Wilson
Department of Philosophy
1866 Main Mall E-370
University of British Columbia
Vancouver, BC V6T 1Z1 CANADA
cathw@interchange.ubc.ca

Notes

[1] V. David Lewis, *On the Plurality of Worlds*, Oxford, Blackwell, 1986.

[2] Several aspects of this wider problem have been noticed and treated in the litera-ture. Critics have asked how mere logical compossibility, or formal criteria such as simplicity and plenitude, can determine or necessarily coincide with the com-position of a qualitatively optimal world. The general direction of the answer to those questions—the conceptual priority of worlds over substances—has been apparent, though it is at odds with Leibniz's apparent commitment to substance priority. Gregory Brown, developing some suggestions of Russell and Hacking, argues that world-forming substances must be enriched with the "laws" of various

worlds; this amounts, I think, to recognizing world-priority. See his "Compossibility and Harmony in Leibniz," *Philosophical Review* 96 (1987) pp. 173-203.

[3] Leibniz, *The Radical Origination of Things* in AG, p. 150.

[4] Ibid. p. 150.

[5] Leibniz, "On the Secrets of the Sublime," 11 February 1676 in G.H.R. Parkinson, tr. and ed., *De Summa Rerum*, New Haven, Yale University Press, 1992 p. 21-23; AK VI:III: 472

[6] Leibniz, "My Principle is: Whatever can exist and is Compatible with Others, Exists," in *De Summa Rerum,* p. 105 AK VI:III: 581).

[7] Leibniz, "On Contingency" c. 1686 in AG, p. 29. Cf. "The source of contingent truths," c. 1685-9, p. 100.

[8] G.H.R. Parkinson's note 4 (p. 138) to ""My Principle is" in his edition of De *Summa Rerum* quotes a definition from AK VI. II: 498: "*Compossibles* are those, one of which being given, it does not follow that the other is negated; or, those one of which is possible, the other being assumed."

[9] For contrasting perspectives on this question, see David Blumenfeld, "Leibniz's Theory of the Striving Possibles." *Studia Leibnitiana* 5 (1973) pp.163-177, and Christopher Shields, "Leibniz's Doctrine of Striving Possibles," *Journal of the History of Philosophy* 24 (1986) pp. 343-359.

[10] Wolfgang Lenzen in "Leibniz on Properties and Individuals," in Kevin Mulligan, ed., *Truth and Ontology*, Dordrecht, Kluwer, 1982, pp. 193-204 envisions a process of pairwise compossibility checking that creates a maximal collection of individuals, but he is concerned with the algebraic structure of Leibnizian combination-theory, not with the production of a qualitatively optimal world.

[11] Leibniz, *Discourse on Metaphysics*, S. 14 in AG, p. 47.

[12] John Earman, in a passage quoted by Brown, notes that "Either harmony of perceptual states is required for compossibility, or else it is not. In the former case, no possible world is disharmonious. In the latter case, the compossibility relation tends to become trivial…." The latter possibility, Earman points out, appears to saddle us with one huge, maximally disharmonious world. "Perception and Relations in the Monadology," *Studia Leibnitiana*, 9 (1977) p. 220.

[13] Thanks to David Blumenfeld for pointing out this possibility.

[14] The calculations here get to be quite complex when various assumptions about compossibility are introduced. Thanks to Paul Bartha for pointing out the complications and helping with these estimates.

[15] Leibniz, *Ultimate Origination,* in AG, p. 150-1.

[16] The suggestion that space and time have certain capacities sounds more

substantivalist than relationalist. Leibniz is supposed to have been, or turned, fiercely antisubstantivalist. I ignore this complication.

[17] Leibniz, *Discourse on Metaphysics* S. 14 in AG, p. 46-7.

[18] World-formation does not imply that substances are brought into spatial proximity since they are prior to space and time; we are simply modeling a non-spatial process of assembly with an intuitive spatial model.

[19] Cf. footnote 18. To be sure, if it is unclear what has been taken away from these homeless substances whose worlds God has destroyed, it is just as unclear what substances lack before they have assembled into worlds.

[20] Leibniz did not want to embrace a system in which Adam's sin was necessary; this would have been Spinozism. But it is a consequence of (1) that there is no possible world in which Adam does not sin, and this suggests that Adam's sin is, after all, necessary. Of course the existence-presupposition is not satisfied in any other possible worlds, and this leaves the logician with a way out. But how can the it-could-have-been otherwise aspect of Adam's sin be expressed if the existence presupposition is not satisfied in any other possible world? Conceptually this seems to require the provision of counterparts—Adamoid figures, in Adamoid-temptation situations, in other possible worlds closely resembling ours. The solution isn't perfect, since the objector will deny that Adam's sin is made contingent by the actions of merely Adamoid beings, but if it is Leibniz's best shot, it is clear why he needs well-developed possible worlds in his system.

[21] The views of the historical Leibniz on the plurality of worlds will be discussed by the author elsewhere. Though the *Theodicy* seems to pronounce decisively for one world, John Leslie's claim in *Value and Existence* (Totowa, Rowman and Littlefield, 1979, p. 203) that "You cannot ... point to where Leibniz says a thing and conclude that its opposite never attracted him" is pertinent.

[22] T, p. 134.

[23] The Leibnizian notion that goodness has an intrinsic striving towards existence is taken up by Leslie, *Value and Existence*, pp. 1-5; see also his remarks on Leibniz and the striving possibles, pp. 200ff.