By Leaps and Bounds: Leibniz on Transcreation, Motion, and the Generation of Minds

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Abstract

This paper traces Leibniz's use of his neologism, "transcreation." Leibniz coins the term in his 1676 discussions of motion, using it to identify a certain type of leap that is essential to motion. But Leibniz quickly dispensed with this theory of motion, arguing instead that "nature never acts by leaps," and the term "transcreation" fell out of use. However, Leibniz surprisingly revived the term in 1709 in his discussion of the generation of rational beings. By contrasting the way Leibniz uses the term in his theory of motion with his use of the term in the generation of rational beings, we will see that Leibniz's arguments against leaps early in his career are less forceful against the leaps purportedly involved in the generation of minds. Nevertheless, the "transcreation" of minds does not necessary entail a discontinuity in the "chain of being."

In this paper, I trace Leibniz's use of his neologism, "transcreation." Leibniz coins the term in his early discussions of motion, using it to identify a certain type of leap that, as he argued at the time, is essential to motion. But Leibniz quickly dispensed with this theory of motion, arguing instead that "nature never acts by leaps," and the term "transcreation" fell out of use. However, Leibniz surprisingly revived the term in his later discussions of the generation of rational beings. By contrasting the way Leibniz uses the term in his theory of motion with his use of the term in the generation of rational beings, we will see that Leibniz's arguments against leaps early in his career are less forceful against the leaps purportedly involved in the generation of minds. Nevertheless, the "transcreation" of minds does not necessary entail a discontinuity in the "chain of being." The deeper interest of this discussion will be to uncover what Leibniz believes is necessary to a natural transition.

Act 1: Early Discontinuities

Leibniz is well known for his defense of the principle of continuity, which he formulates with the Aristotelian slogan, "nature never makes leaps,"[1] and he compares

transitions in nature to the continuous transitions of geometry. A pressing question for anyone defending the principle of continuity, having its basis in geometrical transitions, is why we should assume that geometry is applicable to physics.[2] In a 1676 dialogue called *Pacidius to Philalethes*, Leibniz has one of the characters express the problem exactly:

> If I may be allowed to offer an inexpert opinion on such matters, I would declare that the transition from Geometry to Physics is difficult, and that we need a science of motion that would connect matter to forms and speculation to practice….[3]

This is not an empirical question, since even if certain aspects of the natural world are discovered to be continuous, there are also many apparent *dis*continuities in nature. (Think, for example, of sudden changes in the weather.) Why should the instances of continuous transitions be generalized into a law or principle governing *all* physical changes?

It happens that in 1676, Leibniz is much exercised about this question, and the conclusions he (reluctantly) comes to are (a) that the link between geometry and physics must be via *mind* (whether human or divine, as we shall see), and (b) that in the absence of mind there would be radical discontinuities in nature. But (c) given the intervention of mind into the material world, some (less radical) discontinuities remain.

1.1. "On Motion and Matter"

In a short essay entitled "On Motion and Matter" (which the Academy edition dates somewhere between the 1st and 10th of April 1676), Leibniz states the *dis*continuity thesis clearly: "motion is not continuous, but happens by a leap."[4] He realizes the absurdity of this, saying that "such a position would induce us to believe that a different body is always being recreated, now here, now there," and yet, despite this absurdity, Leibniz finds himself "forced to conclude that motion is not continuous."

The arguments in this essay are brief and incomplete—Leibniz appears to be sketching out some ideas, which he will demonstrate more fully at a later point (as he does in his dialogue, *Pacidius to Philalethes*). For that reason, I will be brief in my presentation of his reasoning here—I will outline just enough to see the trajectory of Leibniz's thought as he builds up to *Pacidius*.

Leibniz identifies several entailments that would force him to the conclusion that motion is discrete. If motion were continuous, then, he concludes, (i) there could not be a change of distance without an actual division of a line into points; (ii) specific motions or modes of motion would be constant and unending; (iii) there would be no explanation for relative velocities; and (iv) "things would produce themselves."[5] Each of these entailments are regarded as impossible or absurd, and so Leibniz denies the antecedent: motion cannot be continuous.

The absurd conclusion, however, is that a body in motion is constantly being "transferred from one place to another in such a way that it does not go through the intermediate places."[6] But given the consequences of assuming the continuity of motion, Leibniz is "forced to conclude that motion is not continuous, but happens by a leap…i.e. that matter is extinguished here, and reproduced elsewhere."[7]

As we will see, in the discussion of *Pacidius*, Leibniz argues that some kinds of leaps are objectionable and absurd while others are not. These subtleties do not appear in "On Motion and Matter." Leibniz here simply bites the bullet, despite the absurdity. But he quickly sees an advantage to the position. If motion is maintained through the constant destruction/resuscitation of bodies, then "a mind always remains intact that assists it." Thus, through the intractable problems of explaining motion in terms of bodies themselves, we are lead to see that "God is the immediate cause of all things."[8]

Leibniz concludes with a striking claim: he says that the discontinuity of motion would show that "there is no other law of nature than [God's] nature itself."[9] This clearly implies that Leibniz was prepared to incorporate reference to God's nature into a full account of natural transitions. There is a clear affinity to Occasionalism in these early essays, and we will see him develop this idea further in *Pacidius* below.

Leibniz is apparently unsettled by the arguments presented in this paper, and he soon repeals one part of the argument. In a note appended to the paper on April 10, Leibniz says,

> Already I am compelled to change something in this, namely, the reasoning that motion is not continuous because then at any point whatever there would be a change of distance, so that there would be as many distances as points. By the same argument it could also be proved that body is not continuous….[10]

That is, Leibniz is rethinking the entailment from continuous motion to (i) above, that there could not be a change of distance without an actual division of a line into points. Instead, he suggests, we should recognize the ideality of the relations expressed in the

change of distance. They are "true entities only when they are thought about by us."[11] The entailment from continuous motion to an actually infinite number of divided points is blocked, since there is no "number of relations" until we conceive of them.

1.2. "Infinite Numbers"

Leibniz returns to this last line of reasoning in a short paper entitled "Infinite Numbers," written on the same day as the appendix to "On Motion and Matter" (10 April 1676). In the appendix to "On Motion and Matter," Leibniz suggests that the "infinite number" of relations is a fiction, something ideal. In "Infinite Numbers," he names among the "fictive entities"[12] the circle, angles, lines, and infinitely small magnitudes. The uniformity expressed in geometric figures and geometric transitions has its basis in the mind: "what must be said is that in the mind there is a thought of uniformity, yet no image of a perfect circle: instead we apply uniformity to this image afterwards, a uniformity we forget we have applied after sensing the irregularities."[13] The uniformity that is being applied to the perceptions of bodies or of motion is something contributed *by us*, an application that Leibniz will characterize in terms of either the thought of uniformity that we apply to an image of a circle or a failure of memory with respect to the circle, misremembering the tiny conscious moments of irregularity.[14] Either way, the perfect circle does not exist naturally and is, rather, ideal.

Against this background of "fictive entities," Leibniz returns to the problems of motion, taking up the question whether an unbounded line could be moved. He concludes that it can be moved "not by a continuous motion, for this is impossible, but by a leap—in other words if it is *transcreated*."[15] *Transcreation* is a term, apparently coined by Leibniz, to refer to the re-creation of matter by God, "now here, now there," which he introduced in "On Motion and Matter." The motion of an infinite line is by leaps because, he says, "motion is nothing but transcreation."[16] Although we *perceive* motion as continuous, the perception of continuous motion should be understood on analogy with the way we might perceive a circle: "continuous motion is imitated in a way, just as polygons imitate the circle."[17] The bridge between the formal and the material is the mental.

In these two short essays, Leibniz has endorsed the following positions:

(A) Motion occurs by leaps and therefore is not continuous.

(B) The leaps from place to place are supported by God's activity of *transcreation*, i.e. the destruction of a body in one place and its resurrection in another place.
(C) The theory of transcreation reveals the true underlying cause of things, namely God's activity in conserving motion.
(D) Because of (C), the laws of nature are the laws of *God's* nature—motion proceeds with law-like regularity due to God's own constancy.[18]
(E) The perception of continuity and uniformity in nature is a product of imagination, filling in the irregularities that we have sensed but forgotten.

These five claims will help answer the initial question about the application of geometry to physics. But the answer amounts to a *denial* that geometry applies directly to physics. Geometry applies to physics only as our imagination papers over the irregularities and discontinuities inherent in material transitions.

Each of these claims—with one exception—will be much more carefully and subtly defended in *Pacidius*. The exception is (E), which seems to drop out of the picture in *Pacidius*. I won't speculate about why (E) is not prominent in *Pacidius*. It *is* clear that the mediation between geometry and physics is still *mind* in *Pacidius*, but in this case the mind of God will be the main focus, as in "On Motion and Matter." Additionally, we will find a much more thorough account of leaps in *Pacidius*, which will help us characterize each of the other claims more precisely.

1.3. *Pacidius to Philalethes*

Pacidius to Philalethes was composed during a layover on a ship from London to Holland in October to November 1676.[19] In this dialogue, Leibniz attempts to lead his readers, in Socratic dialogue form, to the true theory of motion. The two principal characters in the dialogue are Pacidius, playing the role of questioner, and Charinus, a "young man from a distinguished family, who was nonetheless inquisitive and keen to learn."[20] Charinus, the sharp and promising student, is the character who poses the problem, how to connect "Geometry to Physics…matter to forms and speculation to practice."[21]

The arguments merely sketched in "On Motion and Matter" are in *Pacidius* given full expression, leading to the same reluctant conclusion: mo-

tion must be by leaps, aided and supported by a universal intelligence, a theory he again calls by the "new but very beautiful name *transcreation*."[22] But in *Pacidius*, Leibniz offers a more nuanced account of transcreation, arguing that in transcreation the leap bypasses *no* intermediate intervals, and he argues that other sorts of leaps are objectionable. I won't explore all of the arguments against the continuity of motion here, since my main interest is in seeing how Leibniz attempts to bridge geometry and physics, resulting in motion "by leaps."[23]

In *Pacidius,* Charinus confesses his ignorance about the theory of motion, demonstrating in true Socratic fashion that he is now ready to learn:

> When it came to motion, all my care and diligence were of no use, and I could never reach the point where one might comprehend the reasons and causes of forces by the imagination.... For I always became stuck at the very beginning of an incipient motion, since I had noticed that what must come about in the whole of the remaining time must somehow already happen at the first moment.[24]

The paradox of motion is developed in this way in *Pacidius*:[25]

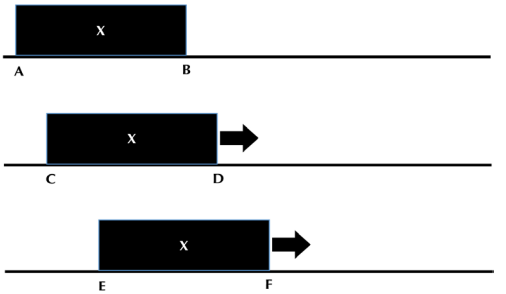
1. Motion $=_{df}$ a change of place.
2. Change $=_{df}$ a state of a thing different from the state of the thing before the change and different from what it would be after the change.
3. But change, by this definition, is impossible.
4. Therefore, motion is also impossible.

In support of premise 3, Leibniz uses the example of the process of dying, there never being a single state that is neither death nor life, and therefore no moment of change *from* one *to* the other. But we can reformulate the same example using motion: If body X is at rest, there must be a moment at which it begins to be in motion. But when is that moment? If the moment that X begins to be in motion is when X is at rest, then X is at rest and moving at the same time. But if the moment X begins moving is when X is moving, then there is no change—X is already in motion. Thus, there must be an intermediate point at which X is neither moving nor at rest, and this is the moment of change.[26] Leibniz develops the problem much more fully in the *Pacidius* dialogue, but this will provide a basis for the arguments I want to focus on.

None of the characters in *Pacidius* are inclined to deny that there is motion, and so they begin looking for a solution. An initial solution offered by Charinus is that there is not a *single* moment that is neither at rest nor in motion, but rather "it is composed from both, and that although it is usually called momentaneous, it in fact contains two moments."[27]

While this might save the definition of motion as a kind of change, it introduces other problems, in particular the problems relating to the continuity of motion.

Suppose there were a body X, which was moving along a plane from AB to EF (see figure below). Either X goes to the place next to (*locus proximus*) AB, designated CD, *or* GH goes from AB to EF "by a leap, so that it does not go through all the intermediate places (e.g., CD)."[28] If X goes through CD—the place next to AB—then the interval from A to C would have to be a mimimum, which takes us into the problems of the composition of the continuum. And the quick admission in the dialogue is that transferring from AB to EF without occupying intermediate places "is impossible."[29] So, upon the hypothesis that motion is via that "next place," we are lead into either the problems of the composition of the continuum *or* to an impossibility.



Later in the dialogue, Pacidius and Charinus return to this conclusion. The new definition of motion as "an aggregate of two existences by which the body is at two neighboring points at two neighboring moments…by continuing the motion we will simply multiply these aggregates."[30] The multiplication of aggregates would entail that "space will be composed of points and time of moments," which they've already conceded is not possible. So, as an alternative, we could think of motion as punctuated by periodic rests (which, presumably, are not always observed). But on this hypothesis, we are led to an infinite regress—each interval of motion would involve periodic rests, which is iterated for each further interval until all motion is "eliminated from nature."[31] Alternatively, we are led to the conclusion that motion does not "pass through the intermediate places," which was rejected as impossible above.

As Leibniz works through these classical paradoxes of change and motion, in each case the argument leads either to an absurdity or to the necessity of leaps. And in each case the leap that results from the argument is a leap that does not pass

through intermediate places—the body transitions from AB to EF, skipping CD and all other intermediate positions. Call these kinds of leaps "j-leaps," since they *jump over* intermediate positions. Charinus notices that he has fallen into the trap of the j-leaps: "With your sleights of hand you've brought it about that it only remains for a body to pass from place to place by a leap, just as if I were immediately transferred to Rome in a single moment."[32] A leap from London to Rome might appear absurd to us, but one might think that such leaps at a micro level would be acceptable. (I'm put in mind of the oddities that many scientists admit at the quantum level today.) But the leaps being advocated in the account of motion are no better for being smaller. "For supposing this corpuscle were given reason and sensation, it would certainly find a lack of proportion in its own leap—which, although tiny to us, is big enough for it—just as we would in ours."[33] Thus, Charinus is inclined to reject the j-leap view of motion. This is a rather unusual argument—anthropomorphizing corpuscles and imagining how things would appear to it—and it doesn't provide a very forceful conclusion. But Leibniz has better arguments up his sleeve.

Pacidius fills out Charinus's objection more carefully. J-leaps, he says, are "offensive to the beauty of things and the wisdom of God."[34] Why? "Wherever we might suppose this leap to occur, we might have avoided it in the same way." Leibniz appeals at this point to the principle of sufficient reason: "the supremely wise author of things does nothing without a reason." Consider the following argument:

(1a) PSR: "the supremely wise author of things does nothing without a reason."

(2a) There is no reason that j-leaps should be ascribed to grade *n* of beings (for any arbitrary grade *n*) rather than grade *n*-1.

(3a) Therefore, the supremely wise author would have no reason to include j-leaps in any grade of being.

(4a) Therefore, there are no j-leaps.

Premise (2a) requires some explanation. By "grade of being," I mean to pick out the relative *size* of the beings, as Leibniz does when he says that "there is no reason why these miraculous leaps should be ascribed to this rather than that grade of corpuscles."[35] For any grade of being, there is some smaller grade, and there is no principled way of deciding which level of reality should admit j-leaps.

But there is an obvious objection: perhaps there is a minimum grade of being. If there were a minimum ("atoms, i.e., bodies so firm that they do not suffer any subdivision or bending"), then there would be a reason for God to create leaps at the level of atoms and no further, since there *is* no lower grade of being. God could

reasonably allow j-leaps at the lowest grade of being.

Leibniz acknowledges this possible objection, and he uses the same form of argument to rebuff it:

(1b) PSR: "the supremely wise author of things does nothing without a reason."

(2b) There is no reason that God should stop creating at grade *n* (for any arbitrary grade *n*) rather than *n*-1.

(3b) Therefore, the supremely wise author would have no reason to create any beings of grade *n* for which there are no further beings of grade *n*-1.

(4b) The hypothesis of atoms includes such beings: atoms are bodies of such a small scale, with no beings of a smaller scale.

(5b) Therefore, there are no atoms.

God's fecundity knows no boundaries, and the implications aren't lost on Leibniz. Atoms would be "creatures without a variety of other creatures inside of them, as if they were paralyzed or dead."[36] God would not create such beings, since God is able to continue creating *ad infinitum*.

There is a further way of expressing the argument against j-leaps, following the same line of reasoning:[37]

(1c) PSR: "the supremely wise author of things does nothing without a reason."

(2c) There is no reason that a moving body should j-leap over places of *n* magnitude (for any arbitrary magnitude *n*) rather than magnitude of *n*-1.

(3c) Therefore, the supremely wise author would have no reason to include j-leaps of any magnitude.

(4c) Therefore, there are no j-leaps.

What this argument entails is that there are no leaps over "infinitely small spaces," since each infinitely small space would include "further infinitely small spaces," *ad infinitum*. The assumption of an infinitely small leap is ruled out by this argument as well, since for any leap of size *n*, there are intervals of size *n*-1 that are being jumped over.

Of course, like the first argument above, one could object to (2c) if one were to grant the existence of minima—minimal magnitudes that cannot be further subdivided. But Leibniz argues at length that a continuum is not an aggregate of minima; for each segment of a line, there is always a smaller, and it can never be resolved into points.[38] Rather, points should be understood as the product of the *division* of a line: "there are no points, lines, or surfaces anywhere else, and in general the

only extrema are those made by an act of dividing: nor are there any parts in the continuum before they are produced by a division."[39] Thus, a point is the boundary of a divided or finite line (as a surface is the limit of a divided or finite body).

These three arguments entail that j-leaps are contrary to the wisdom of God, and characters in the dialogue emphatically reject them. Indeed, the hypothesis of j-leaps and the hypothesis of atoms are regarded as "miraculous." As quoted above, Leibniz calls the j-leaps "miraculous leaps," and with respect to atoms, Leibniz says that

> in addition to the miracle of their utmost solidity (which is a miracle because it cannot be explained without a kind of extraordinary concourse of God), we must without undue inconvenience, attribute this new miracle of jumping from place to place whilst omitting the places in between.[40]

Theories of motion and matter that involve atoms or j-leaps require "a kind of extraordinary concourse of God." There is no way to explain them in terms of the intrinsic properties of the bodies themselves. And the clear indication of the dialogue is that a theory of motion should not appeal fundamentally to miracles.

How do we square these arguments against leaps with the fact that Leibniz does eventually advocate leaps in his theory of motion, going so far as to coin the new term, "transcreation," for it? It is significant that when Leibniz reintroduces transcreation in *Pacidius* he clearly distinguishes it from j-leaps:

> I do not think that we can explain [the movement of a sphere *E* from *B* to *D*] better than by saying that the body *E* is somehow extinguished and annihilated at *B*, and is actually created anew and resuscitated at *D*, which you may call by the new but very beautiful name *transcreation*. Moreover, although this is indeed a sort of leap from one sphere *B* into the other *D*, *it is not the kind of leap we refuted above, since these two spheres are not distant*.[41]

That is, the sort of leap that Leibniz advocates is not a j-leap—none of the intermediate positions are jumped. And yet there are still leaps of a sort. Leibniz continues:

> I add only that transcreation is not what disturbs you: for to say that a thing ceases to exist here, but begins to exist there, with the transition or intermediate state eliminated, is the same thing as saying that it is there annihilated, there resuscitated. And if one person were simply to say that the thing ceases to be in its earlier state and now begins to be in another one, someone else might say that it was annihilated in the earlier state and resuscitated in the later one.[42]

We will call leaps of this sort "t-leaps," to allude to Leibniz's term, "transcreation."

J-leaps are leaps in which certain magnitudes of space are *jumped over*. T-leaps, by contrast, involve leaps of *no intermediate distance*. That is, B and D are touching; they are contiguous points (a point, again, being understood not as a minima but as the limit of an interval).

T-leaps involve an infinite, non-uniform division of space. Imagine a continuous line of motion being actually divided into infinitely many intervals. Any interval you choose is itself infinitely divided, all the way down. Leibniz explains:

> [T]here is no portion of matter that is not actually divided into further parts, so that there is no body so small that there is not a world of infinitary creatures in it. Similarly there is no part of time in which some change or motion does not happen to any part or point of a body…. This does not mean, however, either that a body or space is divided into points, or time into moments, because indivisibles are not parts, but the extrema of parts. And this is why, even though all things are subdivided, they are still not resolved all the way down into minima.[43]

Thus, we have a series of divisions that converges on the infinite, and there is no final resolution of the continuous magnitude into points.

But given this account, Leibniz thinks, we can make sense of the movement of the body by t-leaps. Each boundary of an interval is directly proximate to the boundary of the next interval, without any distance existing between them. (We might say, colloquially, that they are "touching.") The t-leap, then, is the movement from the boundary of the interval that is being concluded to the boundary of the interval that is being initiated. Since there is no distance between these boundaries, the leap does not involve a jump over any intermediate magnitudes.

This story is complicated, and perhaps not even plausible.[44] But my interest here is not whether Leibniz provides a plausible theory of motion. Rather, I'm interested in Leibniz's philosophical motivations to allow for leaps. Why does motion require leaps *of any sort*, much less *t-leaps*? In the dialogue, Pacidius says that,

> No cause can be conceived for why a thing that has ceased to exist in one state should begin to exist in another (inasmuch as the transition has been eliminated), except a kind of permanent substance that has both destroyed the first state and produced the new one, since the succeeding state does not necessarily follow from the preceding one.[45]

One key conclusion of the arguments in *Pacidius* is that bodies by themselves cannot provide an adequate explanation of their motions.[46] On the definition of motion provided, there is no state of the body that can explain its change from one place to

another.[47] Change, if you will recall, was defined as an aggregate of two moments, and there is nothing in the body that can unify the moments. Each subsequent state of a body is discrete and no intrinsic property of the body explains its trajectory, and so motion is fundamentally non-uniform and discontinuous. Thus, the state of change must be explained from the outside, as it were. And we cannot assign the state of change to some *other* body on pain of regress.

As it is summarized in the dialogue:

> [T]here is no moment of change common to each of two states, and thus no state of change either, but only an aggregate of two states, old and new; and so there is no state of action in a body, that is to say, no moment can be assigned at which it acts. For by moving the body would act.... If you really cut to the quick and inspect every moment, there is no action.[48]

Since there is no intrinsic property or state of the body that can explain its movement, strictly speaking, bodies do not (and cannot) act. The interlocutors are not inclined to *eliminate* motion, to explain it away, and so the explanation of motion must be from some other source, a source that *can* and *does* act, namely a "permanent substance." Thus, they conclude, the motion of bodies is due to the continuous creative activity of God, acting in the most perfect manner.

It is notable that in *Pacidius* Leibniz nowhere concludes that motion involves the *miraculous* intervention of God. Recall that j-leaps were regarded as miraculous because they involved an "extraordinary concurrence" of God. In contrast, t-leaps result from God's ordinary concurrence: "For once God has chosen the forms of changes in some stretch of time, he will not change them without a reason."[49] And even in Theophilus's panegyric at the end of the dialogue, Theophilus says that the philosopher "can demonstrate that certain things that are *near enough miracles* happen every day in nature."[50] Presumably t-leaps are not regarded as miracles, since they result from God's original decree and his ordinary concurrence and conservation of creation.[51]

The resulting picture from these three early texts is that Leibniz does allow leaps of a kind, although he does not regard them as miraculous. And, while this position contradicts Leibniz's later claims that "nature never acts by leaps,"[52] ultimately, the more fundamental argument in *Pacidius* is for the impossibility of accounting for motion by appealing to the properties of the bodies themselves. Leibniz provides a much more straightforwardly Occasionalist theory of motion.[53] Leibniz's full commitment to a natural theory of motion and the principle of continuity will emerge only as he comes out from under the Occasionalist tent.

Entr'acte: The Principle of Continuity and Natural Changes

The story of Leibniz's rejection of the Cartesian theory of motion and of occasionalism is well known.[54] While Leibniz developed his theory of transcreation, he was already developing a physics that involved an essential reference to intrinsic qualities of the body. But this theory was to displace *motion* in favor of *force*. As he says in the *Discourse on Metaphysics*:

> [I]f we consider only what motion contains precisely and formally, that is, change of place, motion is not something entirely real, and when several bodies change position among themselves, it is not possible to determine, merely from a consideration of these changes, to which body we should attribute motion or rest….[55]

Notice that the definition of motion given here is the same as that offered in *Pacidius*: motion is a change of place. But, given this definition, motion is relative. If X moves with reference to Y and Z, there is no property in X itself that would allow us to identify X as the body in motion rather than Y and Z. Leibniz continues:

> But the force or proximate cause of these changes is something more real, and there is sufficient basis to attribute it to one body more than to another. Also, it is only in this way that we can know to which body the motion belongs.[56]

The force of a body is the intrinsic quality that is real and grounds all natural changes. He reiterates this to Arnauld, "bodily substance has the force to continue its changes according to the laws that God has placed in its nature and maintains there."[57]

Thus, the notion of *force* took a central place in Leibniz's philosophy, and his view that each substance has within it the force and law necessary for all of its subsequent states became prominent. The revival of substantial forms comes along with this, since force cannot be explained simply in terms of the size, shape, and relative motion of the bodies involved in the natural change. Leibniz's *Specimen of Dynamics* (1695) outlines the physics of force and his *New System of the Nature and the Communication of Substances, as well as the Union between Soul and Body* (1695) shows how the theory of force can be applied more generally and allows for a new theory of the union of mind and body.

The theory is clearly anti-Occasionalist, and in the years leading up to his publication of these key texts Leibniz outlines his specific objections to the Cartesian theory of motion and Occasionalism.[58] The natural laws are now no longer grounded by the laws of *God's* own nature but in the laws governing the localized forces in finite substantial forms. Natural changes are explained by reference to the *natures*

of the individual substances involved, and the miraculous will be any change that "surpass[es] the powers of our nature and even the powers of all limited natures."[59]

Along with these fundamental developments in Leibniz's metaphysics, Leibniz also proposed a principle that would ground any investigation into natural changes: the principle of continuity. According to the "principle of general order," "as the data are ordered, so the unknowns are ordered also."[60] Leibniz appeals to the conic sections as an example of this: as the transition from ellipse to parabola is continuous, the properties of each must also be continuously ordered and so the parabola can be conceived of as an ellipse with infinitely distant foci.[61]

Leibniz introduces the principle of continuity in the context of his rejection of the Cartesian principle of the conservation of the quantity of motion.[62] Since in any natural change, there is a continuous transition from one state to another, the rules governing motion must entail a similar continuity. And since, as was argued above in *Pacidius*, there is no principled way of omitting any particular degree or magnitude of change, all natural changes will occupy all possible intermediate grades or magnitudes.

Thus, the principle of continuity requires that any *natural* transition be made *without leaps*. This principle applies across multiple domains: changes in place, changes of state, and development along the "chain of beings,"[63] and Leibniz quickly makes use of the principle of continuity in many different domains. In a letter to De Volder, Leibniz explicitly rejects transcreation on the basis of its commitment to leaps and then generalizes it to other sorts of natural transitions:

> [O]nce we have assumed that the Author of things has willed continuity of motion, this itself will exclude the possibility of leaps…. [But] since all things happen by the perpetual production of God, or, as they say, by continuous creation, why could he not have transcreated a body, so to speak, from one place to another distant place, leaving behind a gap either in time or in space…? Experience teaches us that this does not happen, but the principle of order proves it too, according to which *the more we analyze things, the more they satisfy our intellect*. This is not true of leaps, for here analysis leads us to mysteries. Thus, *I believe that the same thing applies not only in transitions from place to place but also in transitions from one form to another or from one state to another.*[64]

The transition from rest to motion is one example of a transition from state to state, but Leibniz extends this to other sorts of transitions in state. In the Monadology, Leibniz says that "every created being is subject to change, and therefore the

created monad also, and further that this change is continuous in each one."[65] And in the preface to the *New Essays,* Leibniz uses the principle of continuity to ground continuous changes from non-conscious perceptions to conscious perceptions.[66] But it is also notable that Leibniz includes transitions from one *form* to another, and he argues against any vacuum of forms. He says in a 1702 letter to Varignon,

> [T]he Law of Continuity demands that *when the essential determinations of one being approximate those of another, as a consequence, all the properties of the former should also gradually approximate those of the latter*. Hence it is necessary that all the orders of natural beings form but a single chain in which different kinds like so many links clasp one another so firmly that it is impossible for the senses and the imagination to fix the exact point where one begins or ends….[67]

The continuity that applies to natural changes also applies to the series of things that exist at any given time. All possible (or, rather, compossible) intermediate grades are filled in.

This interlude should provide at least a background sketch demonstrating why Leibniz's early theory of transcreation would be dropped in the 1680s and 90s. Transcreation requires a "leap," and the explanation of motion must be given in terms of God's continual activity in destroying and recreating the material substances. Thus, all natural transitions would exceed the nature of the bodies themselves and, indeed, the power of *any* finite substance. A physics that essentially includes discontinuity and miracles is inconsistent with the natural theory of force that Leibniz is developing during his middle period.

Act 2: Transcreation Resurfaces

With this background in mind, it is surprising to find Leibniz returning to the concept of transcreation. Elsewhere I have argued that Leibniz does not *need* to appeal to transcreation and that, when he did, he always left himself a way out.[68] And so, ultimately, I am doubtful that transcreation ever played an important role in Leibniz's philosophy after 1676. However, it is nevertheless interesting that Leibniz appeared to think that transcreation in limited cases was at least *consistent* with his mature philosophy.

In particular, Leibniz argued that the generation of rational minds might require transcreation. Here is a typical passage:

> I believe that the souls that will one day be human souls, like those of other species, have been in the seeds and in the ancestors all the way back to Adam, and have consequently existed since the beginning of things, always in a kind of organic body.... But it also seems to me likely for several reasons that they existed then only as sensitive or animal souls, endowed with perception and sensation, and lacking reason; and that they remained in this state up until the time of the generation of the man to whom they would belong, but that they then received reason; whether there is a natural way of elevating a sensitive soul to the degree of a rational soul (which I find hard to conceive), or whether God gave reason to this soul by a particular operation, or, if you will, by a species of transcreation. The latter is much easier to admit....[69]

Notice that Leibniz does not unambiguously endorse transcreation, and yet his claim that transcreation "is much easier to admit" is remarkable. The transcreation involved in the generation of a human mind is not quite the same as in the case of motion, in which a corpuscle of matter is destroyed and recreated. Rather, here the transcreation is the addition of reason to a soul that already has the capacity for sensation. It is a kind of augmentation of the soul.

From the discussion of motion above, it is clear that Leibniz carefully worked out an account of transcreation that avoids objectionable leaps. While the motion of a body, under the transcreation model, still involves leaps, they are leaps that are *no distance* from the original position of the body. It is difficult to see how this would work in the case of the generation of a rational soul from an animal soul—what would it be for a rational soul to be "no distance" from an animal soul? Well, one possibility emerges from Leibniz's description of the transcreation of rational minds, which occurs "through the miraculous addition of an essential degree of perfection."[70] The leap from animal soul to rational mind is a leap over degrees of perfection. Could we give a similar account of j-leaps, which bypass some degrees of perfection, and t-leaps, which bypass none?

It seems that Leibniz does *not* have the same reasons to rule out j-leaps in the transcreation of minds. Recall the argument forms given above, in which Leibniz ruled out the possibility of j-leaps in a theory of motion. Applying the arguments to the case of the generation of rational souls, Leibniz might encounter trouble:

(1d) PSR: "the supremely wise author of things does nothing without a reason."

(2d) There is no reason that j-leaps should skip *n* degrees of perfection (for any arbitrary magnitude *n*) rather than degrees of *n*-1.

(3d) Therefore, the supremely wise author would have no reason to include j-leaps of any degree.

(4d) Therefore, there are no j-leaps.

The problem is that (2d) may not be as obvious as it is in the case of motion. In the case of motion or atoms, there would be a stopping point for God *if* there were minima. Likewise here, if there were some minimal degree of perfection that did not itself admit of subdivision, then there would be a reason that God should skip *n* degrees rather than *n*-1 degrees of perfection. But I don't think that this is the central objection to the newly formulated argument, and indeed I doubt that Leibniz would admit of minimal degrees of perfection in this way.

Rather, the objection to (2d) that will have greater weight is that there is some threshold, some quantity of degrees necessary to raise a soul to the level of reason. Compare this case with Leibniz's favored example: the transition of an ellipse to a parabola. When the plane intersecting a cone is at *x* degrees, then the conic projection is an ellipse. But there is a clear point at which the ellipse becomes a parabola, namely, when the intersecting plane is parallel to the surface of the cone. Let us say that when the plane intersects the cone at *y* degrees, it is a parabola. Supposing one wanted to change the ellipse into a parabola, they would need to move the plane precisely $|y - x|$ degrees. To do so by a j-leap would require removing the plane at *x* degrees and replacing it at *y* degrees.

By a similar argument, the PSR does not appear to have the same force against a leap in the case of minds. Assuming there is no intrinsic way for souls to rise to the level of reason, when God sees that a particular soul should be elevated to reason, he will elevate it *at least as much* as is necessary to bring it to the level of reason. (Presumably God might have other reasons for elevating the soul beyond the minimal threshold required.) I know of no reasons given by Leibniz that the degrees of perfection between the rational mind and the merely sensitive soul are contiguous, of no distance from one another.[71] Indeed, it is plausible that the transition would require a j-leap.

As additional evidence for this, Leibniz occasionally speculates that there are beings that occupy the intermediate space between animals and humans, although we never encounter any of them locally.[72] This clearly implies that there is a gap of some distance between sensitive souls and rational minds, a gap that could in principle be occupied by other sorts of beings. When creating a rational mind, God must provide at least enough perfection to make a human being sufficiently beyond the animals. Leibniz says:

> I believe that the stupidest man (if he is not in a condition which is contrary to nature, through illness or some other permanent defect which plays the part of an illness) is incomparably more rational and teachable than the most intellectual of all the beasts; although the opposite is sometimes said as a joke.[73]

While some may doubt Leibniz's claim, given more recent evidence in favor of a higher degree of reason in certain animals than Leibniz had access to, Leibniz clearly believed that there is a significant difference between animal and human rationality.[74]

However, the difference between animals and humans does not immediately entail a discontinuity in the "chain of being." Leibniz speculation that "there may be species intermediate between man and beast"[75] is supported elsewhere in his claims about the continuous nature of species distinctions.[76] To put it another way, Leibniz may be arguing that there is a *continuous* but *non-natural* transition from animal to human.[77] The recognition that the development of rationality requires a miracle does not entail that there is something like a last degree of perfection of the sensitive soul, after which there is a leap to the first degree of perfection for a rational soul. The analogy with the conic sections is again helpful—there is a sharp difference between parabola and ellipses, and yet the ellipses approach the parabola continuously. Similarly with the transition from animal to human—there is a sharp difference between human and the animals, and yet the animals approach the human species continuously. If this is right, then there could, at least in principle, be a continuous transition in the development of a rational mind from a merely sensitive mind, even if the transition is miraculous.

This suggests a deeper issue in Leibniz's use of transcreation. The use of transcreation in later texts may not share the earlier commitment to t-leaps, since the argument from the PSR does not have the same weight. (This is not to say that there might not be *other* arguments based on the PSR that would rule out leaps in the generation of minds.) But the fundamental issue here, unlike in the 1676 texts, is not the *size* of the leap. Rather, we again need to see why Leibniz thinks such leaps are necessary at all, and here we'll see similarities between the early and late texts.

In the 1676 texts, Leibniz rejected continuous motion because there were no properties intrinsic to material objects that could themselves account for the motion. If motion is not a development from the nature of bodies themselves, then God fills in the gaps with his transcreative activity. The same motivation undergirds Leibniz's discussion of transcreation in the generation of rational beings. Leibniz writes to Des Bosses in 1709:

> If you think it paradoxical that a human being cannot be generated without a miracle, then the teaching of all your schools concerning the creation of a rational soul also will be paradoxical, and we shall have to fall back on their preexistence. For if rational souls are concealed in spermata, such a traduction is in fact preexistence. But if you prefer this to God's making rational souls out of irrational ones, I certainly do not object, as I am more inclined to it. Indeed, I have sometimes thought that there are, in fact, innumerable sensitive souls in human spermata, just as in the spermata of all animals, but that those alone have rationality (although it does not yet reveal itself) whose organic bodies are destined at some time to be human, a fact that could already be perceived in them by a sufficiently perspicuous mind. Thus, there will be no need for transcreation.[78]

The alternatives Leibniz presents are (a) transcreation, "God's making rational souls out of irrational ones," or (b) preexistence, "those alone have rationality… whose organic bodies are destined at some time to be human." Leibniz here states a preference for the latter, although, again, it is not definite.[79]

The alternative of preexistence shows what Leibniz regards as the necessary condition on the natural generation of rational minds:

> A soul S can naturally develop into a rational mind only if S already has rationality inhering in it.

In the theory of preexistence, the change from sensitive soul to rational mind does not involve acquiring a new capacity. Rather, it is merely the unfolding of a capacity that already exists in the subject.

The implication of this condition and the arguments for the transcreation of minds above is that there is no *natural* way for the capacities of sensation and perception, the capacities humans share with animals, to develop into rationality. Leibniz often refers to the capacities of animal souls as "shadows" or "imitating" reason,[80] but in light of the arguments presented above, this should not be taken to mean that animals have what it takes such that, with sufficient augmentation, they would be capable of reason. But Leibniz has provided a way to incorporate the development of reason in his view provided there are intrinsic properties or capacities in those souls that will become rational minds that can explain the development. This, it seems, could be done without recourse to miracles (or at least with only whatever miracle is required for the existence of such souls in the first place) and could be done without appeal to leaps.

Conclusion

By connecting Leibniz's early and late discussions of transcreation, we are able to see a deeper feature of Leibniz's system, which was already developing early in his career. The paradox of change, it seems, goes deep into Leibniz's system. The development of any property, P, in a substance can be naturally explained only if the substance *already* has P or the constituents of P expressed in its nature. And this is true for the generation of any organic being:

> always through seeds…there is some preformation…not only the organic body was already there before conception, but there was also a soul in this body; in brief, the animal itself was there, and through conception this animal was merely prepared for a great transformation, in order to become an animal of another kind.[81]

This provides a bridge from Leibniz's discussions of the continuity of natural changes to the predicate-in-subject principle, and it provides one additional reason that Leibniz argued that, "since every present state of a simple substance is a *natural* consequence of its preceding state, the present is pregnant with the future."[82]

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Notes

[1] For a sampling of the wide variety of contexts in which Leibniz appeals to the principle that nature never acts by a leap, see *Specimen Inventorum*, 1688? (A 6.3.1638), Letter to Foucher, January 1692 (A 2.2.491), Letter to Huygens, 10/20 March 1693 (A 2.2.683), Letter to Bossuet, 8/18 April 1692 (A 2.2.516), Letter to L'Hospital, 15 January 1696 (A 3.6.624), Letter to Bernoulli, 20/30 Sept. 1698 (A 3.7.912), Letter to De Volder, 24 March/3 April 1699 (G 2.168/L 515), *Essay de Dynamique*, 1698-1700? (GM 6.229), the *New Essays on Human Understanding*, 1704 (A 6.6.56/NE 56), and "The Metaphysical Foundations of Mathematics," after

1714 (GM 7.25/L 671). The more mathematical formulations of the principle can be found in "Letter of Mr. Leibniz on a General Principle Useful in Explaining the Laws of Nature thorugh a Consideration of the Divine Wisdom," published in the *Nouvelles de la République des Lettres* in July 1687 (G 3.51-55/L 351-53), and *Specimen Dynamicum* (1695) (GM 6.249-50/L 447-48). The term "principle of continuity" or "law of continuity" is used only from 1692 and after.

Note: In addition to the abbreviations listed at the end of this journal, I will use the following abbreviations for Leibniz's works: LC = *The Leibniz-Clarke Correspondence,* ed. H.G. Alexander (Manchester: Manchester University Press, 1956), cited by author, letter number, and section number. LR = *The Leibniz-Des Bosses Correspondence*, trans. Brandon C. Look and Donald Rutherford (New Haven: Yale University Press, 2007). M = *Monadology,* G 6.607-623/AG 213-25. Wiener = *Leibniz Selections*, trans. Philip P. Wiener (New York: Charles Scribner's Sons, 1951).

[2] In the history of mathematics, some have regarded Leibniz's use of the principle of continuity, applied in such a general way to physical transitions, as a mistake. Continuous transitions in mathematics do not entail similar continuous transitions in nature. Carl B. Boyer says, "Leibniz felt the justification for his calculus lay in the ordinary mathematical considerations already known and used, and that is was 'not necessary to fall back on metaphysical controversies such as the composition of the continuum.' Nevertheless, when called upon to explain the transition from finite to infinitesimal magnitudes, he resorted to a quasi-philosophical principle known as the law of continuity" (Carl. B. Boyer, *The Concepts of the Calculus: A Critical and Historical Discussion of the Derivative and the Integral* (Wakefield, MA: Hafner Publishing Co., 1949), 217).

[3] A 6.3.531/Ar 135.

[4] A 6.3.494/Ar 79.

[5] All of the above arguments are given on A 6.3.493-495/Ar 79-81.

[6] A 6.3.493/Ar 79.

[7] A 6.3.493-94/Ar 79.

[8] A 6.3.494/Ar 81. One can almost feel Leibniz's enthusiasm at uncovering another proof for the existence of God, which he reiterates in Pacidius: "If this could be taken as demonstrated, then we would have done something really important. For we would have demonstrated the creator of the universe" (A 6.3.560/Ar 197).

[9] A 6.3.494/Ar 81.

[10] A 6.3.495/Ar 81.

[11] A 6.3.495/Ar 81.
[12] A 6.3.498/Ar 89.
[13] A 6.3.499/Ar 91.
[14] Cf. A 6.3.499/Ar 91 for an interesting digression into issues of consciousness, which Leibniz thinks could explain this failure of memory. For more on consciousness and memory in Leibniz see Larry M. Jorgensen, "Leibniz on Memory and Consciousness," *British Journal for the History of Philosophy* 19 (2011).
[15] A 6.3.500/Ar 93.
[16] A 6.3.500/Ar 93. Leibniz later also speaks of the "transproduction" of things; see A 6.3.503/Ar 99.
[17] A 6.3.503/Ar 99.
[18] This is reiterated in "On Infinite Numbers": "transproduction happens by a certain law" (A 63.503/Ar 99).
[19] See Leibniz's note on A 6.3.529/Ar 129.
[20] A 6.3.529-530/Ar 131. Richard Arthur speculates that Charinus was based on Ehrenfried Walther von Tschirnhaus, with whom Leibniz was well acquainted.
[21] A 6.3.531/Ar 135.
[22] A 6.3.567/Ar 213. See also A 6.3.560/Ar 197.
[23] For an in-depth discussion of the arguments, connecting them with later developments in fractal mathematics, see Samuel Levey, "The Interval of Motion in Leibniz's Pacidius Philalethi," *Nous* 37 (2003).
[24] A 6.3.532/Ar 135.
[25] A 6.3.534-40/Ar 141-57.
[26] Cf. the argument in Plato's *Parmenides*, 156c-157b (Plato, *Plato: Complete Works*, ed. John M. Cooper (Indianapolis: Hackett Publ., 1997), 388-389), referenced by Ar, 404n18.
[27] A 6.3.541/Ar 157.
[28] A 6.3.541/Ar 159.
[29] A 6.3.542/Ar 159.
[30] A 6.3.555/Ar 187.
[31] A 6.3.556/Ar 189.
[32] A 6.3.556-57/Ar 189. Later Charinus says, "I find these leaps of yours very excruciating" (A 6.3.560/Ar 197).
[33] A 6.3.560/Ar 197.
[34] A 6.3.560/Ar 199.
[35] A 6.3.561/Ar 199.

[36] A 6.3.561/Ar 199. Note Theophilus's later astonished remark:

> Those who claimed that [there] are infinite spheres of stars in this mundane space, and that there is a world in every sphere, seem to have said something of importance; whereas you show that in any grain of sand whatever there is not just a world, but even an infinity of worlds. I doubt if anything could be said that is more splendid than this, and more in keeping with divine greatness. (A 6.3.566/Ar 211)

[37] This argument is very briefly given at A 6.3.564-65/Ar 207.

[38] See A 6.3.548-53/Ar 173-81.

[39] A 6.3.553/Ar 181.

[40] A 6.3.561/Ar 199.

[41] A 6.3.567/Ar 213, emphasis added.

[42] A 6.3.567/Ar 213-215.

[43] A 6.3.565-67/Ar 209-10.

[44] I refer interested readers to the objections raised by Michael White and Samuel Levey.

Michael White argues that if there were genuinely no distance between the points at which a body is destroyed and recreated, then it is hard to see how a body would move at all. See Michael J. White, "The Foundations of the Calculus and the Conceptual Analysis of Motion: The Case of the Early Leibniz (1670-1676)," *Pacific Philosophical Quarterly* 73 (1992): 304.

Samuel Levey agrees. He speculates that the theory of motion presented at the end of *Pacidius* represents "a tension in Leibniz's thought between two concepts of motion," and that "a resolution of motion into a powder of points (or leaps) seems to be inevitable—for having cut back every finite interval into finer and finer parts without end, what extended intervals could remain?" See Levey, "The Interval of Motion in Leibniz's *Pacidius Philalethi*," 402.

[45] A 6.3.567/Ar 213-215.

[46] Richard Arthur also makes this point, although he argues that Leibniz, in *Pacidius*, may be tacitly arguing for the "non-material principles of unity," which Leibniz will later call "monads." See Richard T.W. Arthur, "Russell's Conundrum: On the Relation of Leibniz's Monads to the Continuum," in *An Intimate Relation: Studies in the History and Philosophy of Science*, ed. James Robert Brown and Jürgen Mittelstrass (Dordrecht: Kluwer Academic Publ., 1986), 190.

[47] See also Pacidius's reply to Gallutius's appeal to the Aristotelian dictum that "whatever is once set in motion will always move in the same way unless it meets

with an obstruction," A 6.3.568/Ar 215.
[48] A 6.3.566/Ar 211.
[49] A 6.3.568/Ar 215.
[50] A 6.3.570/Ar 219, emphasis added.
[51] I will not try to untangle Leibniz's theory of conservation and concurrence here. Those interested should consult Robert Merrihew Adams, *Leibniz: Determinist, Theist, Idealist* (Oxford: Oxford University Press, 1994), chapter 3, Sukjae Lee, "Leibniz on Divine Concurrence," *Philosophical Review* 113 (2004), Jeffrey K. McDonough, "Leibniz: Creation *and* Conservation *and* Concurrence," *The Leibniz Review* 17 (2007).
[52] See references in fn 1.
[53] For more on Leibniz's early flirtation with Occasionalism, see Daniel Garber, *Leibniz: Body, Substance, Monad* (Oxford: Oxford University Press, 2009), 191-194.
[54] See Paul Mouy, *Le Développement de la Physique Cartésienne, 1646-1712* (Paris: J. Vrin, 1934), 231-236, 293-302, and Gottfried Wilhelm Leibniz and Nicolas Malebranche, *Malebranche et Leibniz: Relations personnelles*, ed. André Robinet (Paris: Vrin, 1955), 243-247. For more on the nature of the disagreement about Occasionalism, see Nicholas Jolley, "Leibniz and Occasionalism," in *Leibniz: Nature and Freedom*, ed. Donald Rutherford and J. A. Cover (Oxford: Oxford University Press, 2005), Gottfried Wilhelm Leibniz and Nicolas Malebranche, *Malebranche et Leibniz: Relations personnelles*, ed. André Robinet (Paris: Vrin, 1955), 243-247, Donald Rutherford, "Natures, Laws, and Miracles: The Roots of Leibniz's Critique of Occasionalism," in *Causation in Early Modern Philosophy: Cartesianism, Occasionalism, and Pre-Established Harmony*, ed. Steven M. Nadler (University Park: Pennsylvania State University Press, 1993)
[55] DM §18. Note that there are a number of important texts between *Pacidius to Philalethes* (1676) and the *Discourse on Metaphysics* (1686), which a full account of the development of Leibniz's thought on this subject would ideally include. Michel Fichant has persuasively argued that *De Corporum Concursu* (1678) is perhaps the pivotal text marking the transition. See Michel Fichant, *La Réforme de la Dynamique: De coporum concursu (1678) et autres textes inédits*, trans. Michel Fichant (Paris: J. Vrin, 1994).
[56] DM §18.
[57] A 2.2.179/LA 116.
[58] See Mouy, *Le Développement de la Physique Cartésienne, 1646-1712*, 300-302
[59] DM §16. See also letter to Arnauld, 30 April 1687 (A 2.2.179/LA 116), Leibniz's

fifth letter to Clarke, §107 (G 7.416/LC 90-91) and T §249 (G 6.265). For discussion on miracles in Leibniz, see Adams, *Leibniz: Determinist, Theist, Idealist*, 94-99, Maria Rosa Antognazza, "The Defense of the Mysteries of the Trinity and the Incarnation: An Example of Leibniz's 'Other' Reason," *British Journal for the History of Philosophy* 9 (2001), and Daniel J. Cook, "Leibniz on 'prophets', prophecy, and revelation," *Religious Studies* 45, no. 3 (2009).

[60] G 3.52/L 351.

[61] This is not original with Leibniz. Kepler made the same sort of argument, calling it reasoning by analogies Johannes Kepler, *Optics: Paralipomena to Witelo and Optical Part of Astronomy*, trans. William H. Donahue (Santa Fe, NM: Green Lion Press, 2000), 106-110. Leibniz generalizes and, as I will show below, argues that this kind of reasoning should be extended to all natural relations.

[62] See, for example, Leibniz's summary in his letter to Arnuald, 22 July/1 August 1687 (A 2.2.219-220/LA 130-131).

[63] I develop Leibniz's principle of continuity as it relates to his theory of mind in Larry M. Jorgensen, "The Principle of Continuity and Leibniz's Theory of Consciousness," *Journal of the History of Philosophy* 47 (2009).

[64] G 2.168-69/L 515-16, last emphasis added. Notice that Leibniz is using "transcreation" in a looser sense here, in a way that allows for j-leaps.

[65] M §10.

[66] A 6.6.56-57/NE 56-57.

[67] Wiener 187.

[68] See Larry M. Jorgensen, "Mind the Gap: Reflection and Consciousness in Leibniz," *Studia Leibnitiana* 43 (2011).

[69] G 6.153/T §91. See also Letter to Des Bosses, 30 April 1709 (G 2.371/LR 127).

[70] Letter to Des Bosses, 30 April 1709, G 2.371 / LR 127.

[71] There are passages in which Leibniz says that minds are infinitely higher than souls (see, e.g., DM §§35-36 Leibniz to Arnauld, 9 Oct. 1687 (A 2.2.257/LA 159-60) and "Reflections on the Doctrine of a Single Universal Spirit" (G 6.532/L 556)), but this shouldn't be taken to mean that soul must be elevated an infinite number of degrees (especially since there *is* no infinite number). Rather, this language should be taken to refer to certain properties of the mind that may be infinitely beyond the properties of the soul. On analogy with the conic sections, there is a finite number of degrees in the transition of an ellipse to a parabola, and yet the parabola can be conceived as an ellipse with infinitely distant foci.

[72] The intermediate species may be elsewhere in the universe. See A 6.6.473/NE 473.

[73] A 6.6.473/NE 473.

[74] And, indeed, there may be reason to think this is right. For a brief defense of this position, although one that explicitly entails a *dis*continuity between animals and humans, see Peter Van Inwagen, *Metaphysics* (Boulder, CO: Westview Press, 2009), 169-172.

[75] A 6.6.473/NE 473.

[76] See, e.g., Wiener 184-88.

[77] For this reason, I think my concerns in "Mind the Gap: Reflection and Consciousness in Leibniz" were overstated.

[78] Leibniz to Des Bosses, 8 September 1709, G 2.389-90/LR 151.

[79] For a more definite statement of preexistence and the development of rational minds by natural processes, see T Preface (G 6.42/Huggard 66) and Leibniz to Wagner (G 7.531), qtd. in Daniel C. Fouke, "Spontaneity and the Generation of Rational Beings in Leibniz's Theory of Biological Reproduction," *Journal of the History of Philosophy* 29 (1991): 36.

[80] See, for example, A 6.6.51/NE 51, PNG §5, and M §26.

[81] M §74. See also "Reflections on the Doctrine of a Single Universal Spirit," 1702 (G 6.532/L 556).

[82] M §22, emphasis added.