Leibnizian Intelligibility

Abstract It is well-known that Leibniz rejected the accounts of gravitation offered by Newton and his followers. But literature on the topic up to present has been content either i) to explain this rejection as a consequence of Leibniz's rejection of the intelligibility of action at a distance; or ii) to regard Leibniz's rejection, given his acceptance of his *own* notion of force, as unjustified. This article provides a fuller account of *why* Leibniz regarded Newtonian gravitation as unintelligible.

The paper divides into two parts. The first part shows that neither of the above explanations suffices to explain Leibniz's rejection of Newtonian gravitation. The second part explicates the notion of intelligibility standing behind Leibniz's charge against the Newtonians. In this part, I begin by cataloguing a list of physical hypotheses that Leibniz takes to be *un*intelligible. I then move to the positive account of intelligibility Leibniz gives in his correspondence with Christian Wolff. Thereby, I show that the different Newtonian accounts of gravitation each undermine the Leibnizian theological tenet that this is the best of all possible worlds.

KEYWORDS: INTELLIGIBILITY; LEIBNIZ-CLARKE CORRESPONDENCE; NEWTON, ISAAC; GRAVITATION; DYNAMICS; FORCE.

1 Introduction

> That means of communication, says he, is invisible, intangible, not mechanical. He might as well have added inexplicable, unintelligible, precarious, groundless, unprecedented. (AG 345 = G VII. 418)

Thus, in his final letter of their exchange, does Leibniz describe the account of gravitation given by Samuel Clarke. It is well-known that Leibniz rejected the accounts of gravitation offered by Newton and his followers. But literature on this topic up to present has been content either i) to explain this rejection as a consequence of Leibniz's rejection of the intelligibility of action at a distance;[i] or ii) to regard Leibniz's rejection, given his acceptance of his *own* notion of force, as unjustified.[ii] This article provides a fuller account of *why* Leibniz regarded Newtonian gravitation as unintelligible.

The argument divides into two parts. The first shows that neither of these accounts explains Leibniz's rejection of Newtonian gravitation. The second explicates the notion of intelligibility standing behind Leibniz's unintelligibility charge. I begin by cataloguing a list of physical hypotheses that Leibniz takes to be *un*intelligible. This yields three necessary conditions on the *Leibniz-Intelligibility* of a hypothesis in physics, each of which I explicate in turn: *distinguishability*, *conceivability*, and *reducibility*. I then move to Leibniz's positive account of intelligibility. Thereby, I show that each of the three main accounts of gravitation given by the Newtonians directly undermines confidence in the Leibnizian tenet that this is the best of all possible worlds.

2 Recent work on Leibniz's dispute with the Newtonians

The main book-length studies on Leibniz's disputes with Newton and his followers remain Hall (1980), and Bertoloni Meli (1993): the former focusing primarily on the priority dispute surrounding the discovery of the calculus; the latter devoting more attention to disputes in natural philosophy. More recent articles include Bertoloni Meli (1999), (2002), and (2006), Hall (2002), Attfield (2005), Brown (2007), and Janiak (2007). Of these articles, Hall and Bertoloni Meli's contributions are more historical in character, while those of Attfield, Brown, and Janiak take up a more evaluative stance.

2.1 The historical backdrop

Leibniz's disputes with the Newtonians divide into two areas: first, those surrounding the nature of force generally and gravitation in particular; second, those surrounding the discovery of the calculus. These conceptually distinct disputes were sometimes intertwined.[iii]

Chronologically, Leibniz's interactions with the Newtonians can be conveniently split into two periods: the first from just before the publication of the first edition of the *Principia* through the 1690s; the second, from after the publication of the second edition of the *Principia* until Leibniz's death.

2.1.1 The earlier correspondence

Newton's earliest attempted interaction with Leibniz is in a letter from June 1676. The letter, however, did not reach Leibniz until quite long after this date. Newton then sent a second letter (GM I. 122-147), primarily concerned with the calculus and cordial in its tone, in October of the same year, which Leibniz received and replied to in June of 1677. In 1684, Leibniz published his first paper on the calculus in the *Acta Eruditorum*, which, as Hall (2002) suggests, prompted Newton to put his own method in print in the 1st edition of the *Principia* in 1687, along with an admission that he had received a letter from Leibniz on his method of the calculus in 1677. As shown by Bertoloni Meli (1993), Leibniz read and took notes on the *Principia* in Vienna prior to writing the *Tentamen de Motuum Coelestium Causis* in Italy in 1689. In 1690, Leibniz published the *De Causa gravitatis, et defensio sententiae Autoris de veris Naturae Legibus contra Cartesianos* in the *Acta Eruditorum*, a work betraying the degree to which Leibniz had already begun to associate Newton's work on gravitation with "the Cartesians" – a name usually used by Leibniz to refer to the occasionalists.[iv]

In 1693, Leibniz reestablishes contact with Newton, leading to a single exchange of brief letters that year. During the 1690's Leibniz is also working tirelessly on his own, massive *Dynamics*, a work he never publishes, and the only public hint of which is his *Specimen Dynamicum*, published in the *Acta Eruditorum* in 1695.

These exchanges of the early period, both private and public, are marked by a fairly high degree of cordiality among all parties. Notably, Leibniz's publications, correspondence, and other writings in natural philosophy from this period form part of an attempt to *win over* atomists, occasionalists, and others to his own physico-philosophical system, typically introducing them to it via his demonstration that Cartesian quantity of motion is not conserved.[v]

2.1.2 The later correspondence

The only other direct correspondence between Leibniz and Newton is in 1712, when Leibniz sends a lengthy philosophical letter to which Newton gives no response. In 1713, Newton spurred on by Roger Cotes, publishes the second edition of the *Principia*, with Cotes himself providing the preface to the work. Leibniz's primary engagements with the Newtonians in this later period are in the *Antibarbarus Physicus* and in the correspondence with Samuel Clarke.

The later interactions differ from the earlier in several important respects. First, Leibniz is not at this time attempting to directly introduce his own physics to the public; and so these works are more directly focused on what is wrong with Newtonian commitments, rather than how they might be corrected by Leibnizian ones. In both the *Antibarbarus Physicus* and the correspondence with Clarke, Leibniz attacks Newton's views on force and gravitation by assimilating them to a discredited or unpopular model: in the former, to scholasticism; in the latter, to occasionalism. Second, Leibniz at this time becomes involved in the priority dispute surrounding the invention of the calculus, having sent a letter to the secretary of the Royal Society disputing accusations of plagiarism, only to have those accusations reaffirmed. Thirdly, the vantage point of these later works is affected both by the negative reception of the dynamics in the late 1690s, as well as by the comparative success of Leibniz's recently published *Theodicy*, especially the favor that work received from Caroline, Princess of Wales, who initiated and was an important third party to the Leibniz-Clarke correspondence (Bertoloni Meli (1999), (2002)). As a result, much of the polemics on both sides of this correspondence attempts to show how the natural philosophy of the opposing side implies an attenuated natural theology.

2.2 Historical understandings

The best known view surrounding Leibniz's rejection of Newtonian gravitation, put forward by Garber (1995) and provisionally settled on by Brown (2007), is that Leibniz fundamentally rejected it because it would have to involve action at a distance. Given that Newton himself rejects this option, this view is usually tied to the claim that Leibniz failed to consider Newton's own position on gravitation, and in particular, fails to recognize the way that Newton's position depends on his own distinction between mathematical deductions and metaphysical hypotheses (Ibid. Cf. Attfield (2007)). According to this position, Leibniz fails to see that for Newton, "'gravitation' was just the name of an observable phenomenon, the accurate description of which allowed the motions of bodies to be understood" (Attfield (2007), 239. Cf. Garber (2012)). Given this failure, Leibniz's rejection was unjustified.

Before settling on the above view, Brown (2007) suggests two alternative reasons why Leibniz might have thought Newtonian attraction unintelligible: first, because it is non-mechanical; second, because it violates Leibniz's principled wall of partition between metaphysics and physics (150). After rejecting the first explanation on the grounds that mechanical explanations are *not* more informative than non-mechanical ones,[vi] and the second on the grounds that "Newton himself had constructed a methodological wall very similar to Leibniz's own" between "'hypotheses' and 'what can be deduced from the phenomena'" (151), he settles on the conclusion that Leibniz rejected Newtonian attraction because it involved action at a distance. Brown then suggests that Leibniz could have accommodated Newtonian gravitation by including it in God's act of creation, concluding that accepting Newtonian

attraction would have forced Leibniz to give up too many of his own philosophical commitments. Leibniz's rejection of Newtonian gravitation is entirely accounted for by his rejection of action at a distance; and Leibniz's rejection of action at a distance is, in Russell's words, a "mere prejudice" (Russell (1937 [1900]), par. 47).

In short, according to the dominant historiographical narrative, Leibniz's dispute with Newton serves as a classic case of adherents of different Kuhnian paradigms talking past each other. "Leibniz is a heritor of the natural philosophical tradition of Descartes, and Newton is a heritor of the mathematical tradition that Galileo followed. The very different ways in which Leibniz and Newton treat the notion of force are […] reflections of that fundamental difference" (Garber (2012), 47).[vii]

As explanations of Leibniz's rejection of Newtonian attraction as *unintelligible*, both the received explanation and Brown's provisionally suggested alternatives remain incomplete at best. Leibniz's insistence on the unintelligibility of action at a distance cannot provide the *fundamental* reason for his rejection of Newtonian gravitation: first, because it only pushes the question back to that of why Leibniz regarded action at a distance as intelligible; second, because while positing gravitation as a primitive quality of bodies was an option taken by some,[viii] this was not the only option available to Newtonians – indeed, it was rejected by Newton himself – nor was it the only one Leibniz considered. Leibniz also addresses the view according to which gravitation is effected directly by a law or direct act of God, advanced in the second edition of the *Principia* by Newton himself;[ix] as well as accounts like the non-mechanical ether account offered by Newton in the queries to the *Optics*.[x]

Part of my contention in what follows will be that though the concern with action at a distance – and the corresponding assimilation of Newtonianism to the abuses of scholasticism – is central to the polemic of the *Antibarbarus Physicus*, the concern with action at a distance is actually secondary to Leibniz's polemic against Newton and his followers. Increasingly, Leibniz's main objection, and the one on which he presses Samuel Clarke the hardest, is that Newton's physical explanation of gravitation turns gravitation into a perpetual miracle; and the main *strategy* Leibniz follows in his attempt to discredit the Newtonians will be to assimilate their position on gravity to a kind of 'localized occasionalism' of the sort associated with Malebranche.

3 Leibnizian Intelligibility

3.1 Leibnizian unintelligibility

A good starting point for our enterprise might be to look at examples of what Leibniz considers *unintelligible*, and his reasons for doing so. Among other things, Leibniz calls the hypotheses of an influx of soul into body (G II. 275 = AG. 181), action at a distance (G V.54 = AG. 301), that matter can think (ibid.), Newtonian attraction (G VII. 342 = AG. 318), and that God could have created the world sooner (G VII. 405 = AG. 341) variously "unintelligible" or "not intelligible."

3.1.1 Distinguishability

Regarding the last mentioned of these, Leibniz writes the following in his fifth letter to Clarke:

> Since I have demonstrated that time, without things, is nothing else but a mere ideal possibility, it is manifest that if anyone should say that this same world which has been actually created might have been created sooner without any other change, he would say nothing that is intelligible. *For there is no mark or difference whereby it would be possible to know that this world was created sooner* (G VII. 405 = AG. 341; emphasis mine).

Here, Leibniz indicates one criterion on the intelligibility of a hypothesis—let us call it the *Distinguishability criterion*. This criterion states that a class of hypotheses $\mathcal{H}$ is intelligible only if there is some possible way to distinguish between the state of affairs posited by a member *h* and that which would obtain under a contrary hypothesis *h'* in $\mathcal{H}$.[xi] In the above case, Leibniz states that there would be no noticeable difference between the present world and a world identical in all respects except that of having been created earlier (or later) than the present world. Therefore, the hypothesis that God could have created the world earlier than he had is unintelligible.[xii]

3.1.2 Conceivability

A second determinant Leibniz places on intelligibility is *conceivability*. For instance, in his preface to the *New Essays*, he writes that "everything in conformity with the natural order can be conceived or understood by some creature" (G V. 58 = AG. 304). This, of course, does not mean that Leibniz rejects everything that he does not understand; it merely entails that Leibniz rejects explanations that he views as *incapable* of being understood. For instance, defending the view that matter is mechanically neither capable of sensation nor of reasoning, Leibniz writes, "I recognize that we are not allowed to deny what we do not understand, though I add that we have the right to deny (at least in the order of nature) what is absolutely unintelligible and inexplicable" (ibid). Here, Leibniz insists that the natural order is fundamentally able to be understood by intelligent creatures like ourselves.[xiii]

An important aspect of Leibniz's use of this criterion is the way it implicitly engages in a debate with the occasionalists. Consider the following quote from Malebranche:

> As I understand it, a true cause is one in which the mind perceives a necessary connection between the cause and its effect. Now, it is only in an infinitely perfect being that one perceives a necessary connection between its will and its effects. Thus God is the only true cause, and only he truly has the power to move bodies. I further say that *it is not conceivable* that God would communicate to men or angels the power he has to move bodies (Malebranche, *Oeuvres*, vol. I, 649 = Lennon and Olscamp, 450. Emphasis mine).

In this passage, Malebranche argues for occasionalism on the grounds of the inconceivability of the opposing hypothesis. Part of Leibniz's general strategy against the occasionalists is to show that it is inconceivable that the occasionalist thesis itself would hold.[xiv]

It is in relation to such a conceivability test that Leibniz sets forth his views about the necessity of mechanical explanations in the physical realm. Shortly after the passage quoted above from the preface to the *New Essays*, Leibniz writes:

> Thus, we can judge that matter does not naturally have the attraction mentioned above, and does not of itself move on a curved path, because it is not possible to conceive how this takes place, that is to say, it is not possible to explain it mechanically, whereas that which is natural should be capable of becoming distinctly conceivable, if we were admitted into the secrets of things. (G V. 59 = AG. 304)

Several points need to be gleaned from the above passage.

First, Leibniz calls the hypothesis of material attraction *conceptually impossible*. Thus for Leibniz, the unintelligibility of Newtonian gravitation is not so easily surmountable that he could make Newtonian gravitation intelligible simply by claiming, as Brown (2007) claims, that matter is essentially attractive.[xv]

Second, by equating conceivable explanations (at least in physics) with mechanical explanations, Leibniz claims that mechanical explanations are the *only* conceivable explanations of physical phenomena.

Third, in making the above claims, Leibniz sets the dependency relation between intelligibility and the mechanist hypothesis in one direction: it is not the case that mechanical explanations are intelligible *because* they are mechanical; rather, mechanical explanations are intelligible because they meet a conceivability standard that hypotheses like universal attraction, according to Leibniz, fail to meet.

3.1.3 Reducibility

Leibniz's third determinant on intelligibility might be variously described as a simplicity, reducibility, or anti-primitiveness criterion. While it might seem unlikely that a philosopher committed to the existence of the actual infinite – indeed, to an infinite of actual infinites – would care much for parsimony, Leibniz's philosophy is deceiving on this point. Consider the following passage:

> [W]e should criticize those who hold these subordinate principles as primitive and inexplicable, as, for example, those who fabricated miracles, or those who fabricated incorporeal ideas that produce, regulate, and govern bodies, those who put forward the four elements [...] as if they contain the ultimate explanation of things, or those who, uninterested in understanding the particular force by which we evacuate with pumps, [...] set up in nature which abhors, as it were, the vacuum a primitive, essential, and insuperable quality. And whoever isn't, with us, eager to know qualities hitherto hidden [...] has invented qualities of eternal obscurity, [...] which not even the greatest genius can know or render intelligible (G VII. 341-42 = AG. 317).

The common thread binding together the above examples is, according to Leibniz, that they all treat subordinate principles as if they were elementary, a procedure which Leibniz identifies as inventing "qualities of eternal obscurity," – qualities that are not merely unintelligible, but necessarily so.[xvi]

There is a *prima facie* conflict between what I have referred to as Leibniz's commitment to simplicity and his commitment to an actual infinity of substances. But Leibniz's is not a commitment to simplicity in terms of tokens, but *types*. The point may be made by comparing his own commitment to simplicity with that of Newton.

In a letter from 1693, Newton writes to Leibniz that "since nature is very simple, I have myself concluded that all other causes are to be rejected and that the heavens are to be stripped as far as may be of all

matter" (GM I. 171 = AJ.109). Here, Newton takes his belief in the simplicity of nature as license to do two things: a) empty space of unnecessary ontological tokens (i.e. he commits himself to the hypothesis of a vacuum); and b) posit an additional ontological type – Newtonian attraction.

By contrast, Leibniz commits himself on the grounds of simplicity to an abundance of ontological tokens and – at least strictly speaking – only *one* ontological type, to which all other phenomena are to be reduced: the monad or simple substance.[xvii] In a letter to De Volder he writes, "the phenomena of aggregates come from the reality of monads" (G II. 250 = AG. 176), and in another letter to the same he writes that "[C]orporeal mass, which, is thought to have something over and above simple substances, is not a substance, but a phenomenon resulting from simple substances, which alone have unity and absolute reality" (G II. 275 = AG. 181). Thus, Leibniz is convinced that Newtonian attraction will ultimately be reducible to simple substance or a phenomenon of simple substance, and that there is no need either to posit gravity as an *additional* primitive ontological type, or to have recourse to the perpetual miracle according to which God himself causes gravity directly.

3.2 Intelligibility

3.2.1 In General

From here, we transition to Leibniz's positive views on intelligibility. Our analysis shall be concerned with two points: first, Leibniz's identification of intelligibility with truth; second, his association of intelligibility with perfection.

In a short 1689 paper addressing Copernican planetary theory, Leibniz writes that, "the truth of a hypothesis is nothing but its intelligibility" (AG. 91), and again that "the truth of a hypothesis should be taken to be nothing but its greater intelligibility" (AG. 92).[xviii] In the second of these quotes, Leibniz identifies the truth of a hypothesis with *greater* intelligibility, thereby suggesting hypotheses admit *degrees* of intelligibility.[xix] In the paper, the Copernican hypothesis is advocated as *more* intelligible than the Ptolemaic, without thereby wholly denying the intelligibility of Ptolemaic astronomy.

Regarding the second point, Leibniz writes in a 1715 letter to Wolff:

> The perfection about which you ask is the degree of positive reality, or what comes to the same thing, the degree of affirmative intelligibility, so that something more perfect is something in which more things worthy of observation are found (GLW. 161 = AG. 230).

Here, Leibniz identifies intelligibility with both perfection and positive reality.

Now the following questions, among others, may be raised about the above identifications. First, what does Leibniz mean by truth? Second, what does Leibniz mean by perfection? Third, are the identities in question necessary or contingent?

Leibniz famously answers the first question by stating that truth is "always an implicit or explicit identity" (AG. 31), and that truth is "the containment of the predicate in the subject" (AG. 98). [xx] For Leibniz, primary truths are explicit identities, e.g. A = A (AG. 30). Secondary truths, however, are *implicit* identities, arrived at via a conceptual analysis wherein the concepts in question are reduced back to an

identity, i.e. where the predicate is shown to be contained in the subject.[xxi] Furthermore, Leibniz distinguishes between necessary and contingent truths by holding that necessary truths admit of a finite proof, whereas contingent truth "obtains only by an argument of infinite length" (Rescher (2001), 149). In other words, all truths are ultimately analytic, but contingent truths are incapable of finite resolution.

Thus, Leibniz's statement that "the truth of a hypothesis is nothing but its intelligibility" (AG. 91) gives us several additional clues about his views on intelligibility. First, a hypothesis is made more intelligible when it is more explicitly able to be reduced via conceptual analysis to an identity. Second there is a sense in which, via this process of analysis, a hypothesis that was once obscure can *become* more intelligible.[xxii] Leibniz describes his rehabilitation of Aristotelian forms in just this way:

> Just as our age has already saved from scorn Democritus' corpuscles, Plato's ideas, and the Stoics' tranquility in light of the most perfect interconnection of things, so now we shall make intelligible the teachings of the Peripatetics concerning forms or entelechies, notions which seemed enigmatic for good reason, and were scarcely perceived by their own authors in the proper way (GM VI. 235 = AG. 118).

Leibniz analyzes perfection—the second concept with which he identifies intelligibility—into two components: variety and order.[xxiii] Thus a given state of affairs *x* is maximally intelligible iff it is brought about by the most simple laws by which said state is able to be obtained; and one state of affairs is more intelligible than another to the degree that it is both simpler in its laws and more varied in its phenomena. Hence, Leibniz's claim that brute Newtonian attraction is unintelligible would by transitivity entail that it – be it miraculous, an occult quality of bodies, or a non-mechanical ether – would itself contribute to a less than optimal world.[xxiv]

Unfortunately, Leibniz never, so far as to my knowledge, directly addresses the question of whether the above identities necessary or contingent. But I think that some considerations internal to Leibniz's philosophy and correspondence can provide us with a relatively certain answer.

Leibniz's identification of intelligibility and perfection occurs within a correspondence with Wolff, who begins this particular thread of enquiry by requesting "to know how Your Excellency [i.e.Leibniz] usually defines perfection" (GLW 160 = AG. 230). After hearing Leibniz's answer, Wolff writes that "I have […] found that your definition of perfection answers my needs in many ways" (ibid.). In his response to that letter, Leibniz writes, "I am gratified to know that you are not displeased with my very general definition of perfection" (GLW 161 = AG. 231). It is clear, then, that in the correspondence, Wolff and Leibniz are looking for a definition, or the essence or meaning of a given concept—in this case, perfection. Thus, insofar as Leibniz is defining perfection, he sees himself as uncovering the essential or necessary structure of the idea thereof. So, the identity given here between intelligibility and perfection is necessary.

Leibniz's identification of intelligibility and truth, however, would have to be contingent. For if the most perfect state of affairs is necessarily the most intelligible, and the most intelligible is necessarily true, then it would follow that the most perfect state of affairs—i.e. this best of all possible worlds—would necessarily be the true state of affairs, i.e. that which actually obtained. In other words, the best of all

possible worlds would *necessarily* be the actual world, or to put it another way, this world would necessarily exist. But the Spinozistic fatalism of this conclusion is something Leibniz was zealous to deny.[xxv] Thus, while the essential identification of intelligibility and perfection is necessary and finitely analytic, the kind of necessity associated with the identification between intelligibility and truth would have to be that associated with the principle of sufficient reason, and therefore not finitely resolvable.[xxvi]

3.2.2 With respect to Newtonian gravitation

3.2.2.1 Leibniz's theological polemic

In the letter to Caroline beginning his correspondence with Clarke, Leibniz wrote:

> Sir Isaac Newton and his followers also have a very odd opinion concerning the work of God. According to their doctrine, God Almighty needs to wind up his watch from time to time, otherwise it would cease to move. He did not, it seems, have sufficient foresight to make it a perpetual motion. No, the machine of God's making is so imperfect, according to these gentlemen, that he is obliged to clean it now and then by an extraordinary concourse, and even to mend it, as a clockmaker mends his work. (G VII. 352 = *LC* 4)

In the above, Leibniz is alluding to an analogy used to compare his own system of pre-established harmony to the Cartesian system of occasional causes. Here is the version of the analogy Leibniz gives in his clarifications of Bayle's difficulties with Leibniz's system:

> One can imagine three systems for explicating the communication one finds between the soul and the body, namely: (1) the system of influence of the one on the other, which is that of the schools [...] (2) that of a perpetual supervisor, who represents in the one what occurs in the other, a little as if a man were charged to make two bad clocks, which were incapable of agreeing with each other themselves, always to agree, and this is the system of occasional causes, and (3) that of a natural agreement of two substances, such as there would be between two clocks perfectly exact. (G IV. 520, translation mine).

Leibniz uses this example on multiple occasions in a number of different ways: sometimes to explicate the union of soul and body, at other times to explain the harmony of substances with each other, and at other times to explain the unity of perceptions in a single substance.[xxvii] The analogy seems to have originally been inspired by an experiment of Christiaan Huygens (G IV. 498). But in spite of its varied uses, it is always used to compare Leibniz's system to occasionalism in some way or another. In the passage in the letter to Caroline, the allusion is to the fact that the Newtonians, following the Cartesians, took the measure of force preserved in the universe to be quantity of motion, or mass multiplied by velocity. As Malebranche put it,

> God chose the simplest laws based on the single principle that the stronger must prevail over the weaker; and on the condition that there would always be the same quantity of motion in the world from the same direction, I claim that the center of gravity of bodies before and after their impact always remains the same, whether that center is at rest or in motion. (*Dialogues* X.XVI = JS. 190).

Leibniz, by contrast, had taken the correct measure to be mv^2, in accordance with his *Brevis Demonstratio* of 1686 (GM VI. 119-23). Newton and his followers, however, were aware that quantity of motion is not naturally conserved, and had used this to explain the need for "active principles [...] or the dictates of a will" to intervene in the system of the world to amend it (*LC* 107; cf. G VII. 354-55 = *LC* 6). Throughout the Leibniz-Clarke correspondence, Leibniz repeatedly presses this analogy to tie Newton to the occasionalists, and in particular to suggest that gravitational attraction is miraculous (G VII. 357 = *LC* 9; G VII. 366-7 = *LC* 17-18; G VII. 376 = *LC* 26-27).

The second, more surprising way Leibniz ties Newtonian philosophy to the occasionalists is through his repeated attempts to characterize Newton's God as the soul of the world. According to Leibniz, Malebranche's occasionalism, since it does not preserve the distinction between the natural and supernatural, collapses into Spinozism. In a reply to Bayle, he writes:

> It does not seem necessary to me to remove action or force from creatures, under the pretext that they would create if they produced modes. For it is God who conserves and continuously creates the forces [of creatures] [...][W]ithout this, I find [...] that God would produce nothing, and there would be no substance apart from his own, which takes us back to all the absurdities of Spinoza. It also seems that the error of this author comes from nothing besides that he puts forth the consequences of the doctrine that remove force and action from creatures. (G IV. 567-68, translation mine; cf. G IV. 509, 515).

Here, Leibniz is clear that in ascribing actions immediately to God, occasionalists and others make God the very nature of the things otherwise thought to perform the action. While the Newtonians don't appeal to God to account for *all* bodily interactions, they nevertheless do posit what Leibniz views as the root of the occasionalist view, that "Natural and Supernatural are nothing at all different with regard to God, but distinctions merely in Our Conceptions of things." (Clarke, G VII. 362).

Furthermore, we know that some Newtonians fully embraced the language of occasionalism in their explication of Newton's *Principles*. Here, for instance, is Cotton Mather's description of Newtonian gravitation:

> "You will see [if you study physics] that the Influences of one thing upon another in the Course of Nature are purely from the Omnipotent and Omnipresent God, actually forever at Work, according to His own Laws, and putting His Laws in Execution, ad as the Universal Cause producing those Effects, whereof the Creatures are but what One may call, The Occasional Cause. You will also be often and quickly carried up into those Immechanical Principles, from whence, The next step is unto God! The Gravitation of Bodies is One of them; for which No cause can be assigned, but the Will of the Glorious God, who is the First Cause of all." (*Manductio ad Ministerium*, 50. Quoted in McCracken (1983), 319).

3.2.2.2 Occasionalism and the Newtonians

Leibniz's attempt to assimilate Newtonianism to occasionalism, and through occasionalism to Spinozism, was to some extent justified by Newton's own philosophical views and tendencies. Newton does hold that absolute motion is proportionate to quantity of motion (*Principia*, Bk. 1, scholium to definitions =

Cohen 412). Along with Clarke (G VII. 354), Newton is suspicious of granting objects powers and actions, lest God be deprived of his glory: "Indeed, however we cast about we find almost no other reason for atheism than this notion of bodies having, as it were, a complete, absolute, and independent reality in themselves" (AJ. 32). God's presence in the world is secured by depriving bodies of superfluous principles that would seem to make them more independent. We see this, for instance, in Newton's reasons for denying the existence of substantial forms in the *De Gravitatione*:

> [F]or the existence of these beings it is not necessary that we suppose some unintelligible substance to exist in which as subject there may be an inherent substantial form; extension and an act of the divine will are enough. Extension takes the place of the substantial subject in which the form of the body is conserved by the divine will; and that product of the divine will is the form or formal reason of the body denoting every dimension of space in which the body is to be produced. (AJ. 29)

Lastly, Newton is fairly explicit in assuming not merely that God produces gravity directly, but 1) that he does so by being directly present to the objects attracting each other, and that 2) this is possible because of the way in which space is an effect of God. According to Newton,

> [S]pace is an emanative effect of the first existing being, for if any being whatsoever is posited, space is posited. [...] So the quantity of the existence of God is [...] infinite in relation to the space in which he is present. (AJ. 25)

Newton goes on to say that

> [S]pace is eternal in duration and immutable in nature because it is the emanative effect of an eternal and immutable being. If ever space had not existed, God at that time would have been nowhere; and hence he either created space later (where he was not present himself), or else, which is no less repugnant to reason, he created his own ubiquity. (AJ. 26).

Thus, we have it that space is uncreated.

We further have it that Newton himself identifies space with extension: after making the above remarks on the nature of space, he continues: "Now that *extension* has been described, it remains to give an explanation of the nature of body" (AJ. 27). The context is one wherein Newton is distinguishing space/extension from body, and arguing against the commonly held view that extension is a property of bodies. And so, not only is space uncreated, space is uncreated extension, which is an emanative effect of God. If, then 'emanative effect' could be identified with either 'attribute' or 'affection', Newton would agree straightforwardly with the first half of the following corollary of Spinoza:

> It follows that *res extensa* and *res cogitans* are either attributes of God or (by axiom 1) affections of God's attributes. (*Ethica*, Bk. I, proposition XIV, corollary ii, my translation).

If this is right, we can clearly see in Newton a kind of piety that seeks to ensure the presence of God in the world by requiring His immediate presence for otherwise ordinary operations: gravitation, material

composition, etc.; and a corresponding tendency to remove active principles from created substances as far as possible to ensure creaturely dependence.

3.2.2.3 Recapitulation and Summary

With the above analysis completed, it is now possible to give a more unified account of why Leibniz rejected Newtonian attraction as unintelligible.

First, neither Newton nor any of his followers offer Leibniz a satisfying explanation of what Newtonian attraction *is*. Leibniz states that gravity is, according to the Newtonians, either an occult quality, a miracle, or unintelligible. So the best possible scenario for the Newtonians would be one in which Newtonian attraction *was* intelligible *per se*, but they had utterly failed to make their case to Leibniz.

But this last option is barred by the approach of Newton, Clarke, Cotes, and others, who themselves insist in their various ways that gravity is primitive. Furthermore, the world in which gravity has some sort of irreducible ontological status is, by Leibnizian lights, less simple than the optimal world (because it would contain more ontological types than necessary), and therefore less intelligible.[xxviii]

But while earlier I suggested that Leibniz would have thought such primitive positing rash, Leibniz's reasons behind his objection to Newtonian attraction go deeper than this. Since Leibniz identifies intelligibility and perfection, and since Leibniz holds Newtonian attraction to be unintelligible especially on account of its alleged primitiveness, it follows that the world in which primitive Newtonian attraction obtains could not be the best of all possible worlds. The God who made such a world would be, by Leibnizian lights, arbitrary, and the principle of sufficient reason – according to which God supposedly acts – would not obtain.[xxix]

Leibniz himself indicates this essential conflict between primitive Newtonian gravitation and the principle of sufficient reason when he writes in his final letter to Clarke:

> Has not everybody made use of this principle [of the want of a sufficient reason] upon a thousand occasions? It is true, it has been neglected out of carelessness on many occasions, but *that neglect has been the true cause* of chimeras such as are, for instance, an absolute real time or space, a void, atoms, attraction in the Scholastic sense, a physical influence of the soul over the body, and a thousand other fictions, either derived from erroneous opinions of the ancients, or lately invented by modern philosophers. (G VII. 419-20 = AG. 346; emphasis mine)

As Leibniz sees it, to accept any of the above Newtonian "hypotheses" as presented by them is to deny the principle of sufficient reason, and to deny that principle is to be reduced to absurdity.

4 Conclusion

Leibniz's ultimate reason for rejecting Newtonian attraction is not that it involves action at a distance: but that the existence of such a primitive attraction would lead to a less intelligible and less perfect world. Nor would Leibniz be able to make Newtonian gravitation intelligible by mere fiat: the very method by which it is posited is at odds with Leibnizian criteria of simplicity.

Consequently, Leibniz's rejection of (and Newton's acceptance of) attraction involves him in an answer to a much graver question than the received analysis implies: namely, the question of whether this *actual* world is fundamentally intelligible. Leibniz, in part based on theological considerations of God's benevolence and goodness, inflexibly insists that it is; Newton, in part based on theological considerations of God's omnipotence and lordship, holds – at least by Leibniz's lights – that it is not. Thus, the debate between Leibniz and Newton over Newtonian attraction echoes a larger debate of enduring meaning in which philosophers, scientists, and historians of both these disciplines might partake.

Abbreviations

AJ = *Newton: Philosophical Writings*. Ed. Andrew Janiak. Cambridge: Cambridge University Press, 2004

AG = *G. W. Leibniz: Philosophical Essays*. Ed. and trans. Roger Ariew and Daniel Garber. Indianapolis: Hackett, 1989.

G = *Die philosophischen Schriften von G. W. Leibniz*. Ed. C. I. Gerhardt. Berlin: Weidman, 1875-1890. Reprint, Hildesheim: Georg Olms, 1978. Cited by volume and page.

GLW = *Briefwechsel zwischen Leibniz und Christian Wolff*. Ed. C. I. Gerhardt. Hildesheim: Georg Olms, 1963.

GM = *Leibnizens Mathematische Schriften*. Ed. C. I. Gerhardt. Berlin: A. Asher, and Halle: H. W. Schmidt, 1849-1863. Reprint, Hildesheim: Georg Olms, 1971. Cited by volume and page

H = *Theodicy*. Trans. E. M. Huggard. New Haven: Yale University Press, 1952. Reprint, La Salle, Illinois: Open Court, 1985

JS = *Nicolas Malebranche: Dialogues on Metaphysics and on Religion*. Ed. Nicholas Jolley and David Scott. Cambridge: Cambridge University Press, 1997.

LC = *G. W. Leibniz and Samuel Clarke: Correspondence*. Edited, with Introduction, by Roger Ariew. Indianapolis: Hackett, 2000.

LO = *Nicolas Malebranche: The Search after Truth*. Trans. T. M. Lennon and P. J. Olscamp. Columbus: Ohio State University Press, 1980; republished with a new introduction by T. Lennon, in Cambridge Texts in the History of Philosophy, 1997.

OC = *Oeuvres complètes de Malebranche.* Ed. A. Robinet. 20 vols. Paris, Vrin, 1958-76.

PM = *The 'Principia'. A new translation by I. Bernard Cohen and Anne Whitman assisted by Julia Budenz. Preceded by A Guide to Newton's Principia, by I. Bernard Cohen.* Berkeley: University of California Press, 1999.

TSHT = *The Correspondence of Isaac Newton*. Ed. by H. W. Turnbull, J. F. Scott, and L. Tilling. 7. Vols. Cambridge, UK: Cambridge University Press 1959-77. Referred to by volume and page number.

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[i] Cf. Garber (1995).

[ii] Cf. Brown (2007).

[iii] This section is much indebted to Hall (2002) and Bertoloni Meli (2002).

[iv] G IV. 509; G IV. 520; G VII. 356. This identification seems to have been commonplace. Cf. G IV. 488-89.

[v] See, for instance, GM VI. 123-128.

[vi] At least in the sense of 'informative' captured by having predictive power.

[vii] An indirect threat to this received narrative comes from Janiak (2007), who shows that one aspect of this story – the assimilation of Newton's distinction between the mathematical and real treatment of force to that between the Copernican model of planetary motion as a heuristic tool and a physical hypothesis – is in important respects mistaken. Janiak writes,

> If Newton intended to treat gravity as purely mathematical, as a mere calculating device, we would not expect him to contend that it 'really exists.' And he does not dodge the implication that, as a real force, gravity bears causal relations [...]. So although Newton is agnostic in the *Principia* on the underlying *cause* of gravity […] his agnosticism does not hinder him from claiming that gravity prevents the moon from following the inertial trajectory along the tangent to its orbit (130).

According to Janiak, 'mathematical' and 'physical' do not name modifications of the type of entity under examination – for instance, gravity; rather, they are modifications of the *way* of treating that type, which itself is antecedently regarded as really existing (ibid., 132).

[viii] Notably, by Roger Cotes in his preface to the second edition to the *Principia* (PM. 392). Cf. Locke, *Works* III, 467-68:

> The gravitation of matter towards matter, by ways inconceivable to me, is not only a demonstration that God can, if he pleases, put into bodies powers and ways of operation, above what can be derived from our idea of body or can be explained by what we know of matter, but also an unquestionable and everywhere visible instance, that he has actually done so.

[ix] "Thus, the ancients and the moderns, who own that gravity is an *occult quality*, are in the right, if they mean by it that there is a certain mechanism unknown to them, whereby all bodies tend towards the center of the earth. But if they mean that the thing is performed without any mechanism by a simple primitive quality, *or by a law of God* [emphasis mine], who produces that effect without using any intelligible means, it is an unreasonable occult quality, and so very occult, that it is impossible it should ever be clear, though an angel, or God himself, should undertake to explain it" (G III. 519 = AJ.112).

"I objected that an attraction properly so called, or in the Scholastic sense, would be an operation at a distance without any means of intervening. The author answers here that an attraction without any means of intervening would indeed be a contradiction. Very well. But then, what does he mean when he will have the sun to attract the globe of the earth through an empty space? Is it God himself that performs it? But this would be a miracle if ever there was any" (G VII. 418 = AG. 345).

At first sight, positing gravity as a *law* of God, and positing it as an *action* would appear to be two different things. However, it was a common trope among occasionalist philosophers to identify God's laws with God's very act of willing. This identity is likely assumed by Leibniz's Newtonian interlocutors. See McCracken (1983), 91.

[x] See G VII. 340 = AG. 318

[xi] Note that this is not Leibniz's principle of the Identity of Indiscernibles, but it *is* a close cousin of it. The identity of indiscernibles is a principle on *objects*: objects which cannot be distinguished from each other are identical. A straightforward extension of the principle holds that *states of affairs* which are indistinguishable are the same state. Assuming, then, that hypotheses are distinct to the degree that they posit distinct states of affairs, it follows

that hypotheses are distinct when they posit states of affairs that are distinguishable from each other. A special case of this, the one used in the above passage, holds that a hypothesis positing a state of affairs as distinct *from itself* is unintelligible.

[xii] Leibniz appeals to this same criterion in his argument against absolute motion. Responding to Clarke's claim that a finite material universe might move through some absolute space, Leibniz writes:

> It does not appear reasonable that the material universe […] should have any motion otherwise than as its parts change their situation among themselves, *because such a motion would produce no change that could be observed,* and would be without design. […] motion indeed does not depend upon being observed, *but it does depend upon being possible to be observed* (G VII. 403 = AG. 340; emphases mine).

Here again, the intelligibility of a hypothesis depends upon the distinguishability of the state of affairs consequent upon it from other possible states of affairs where the hypothesis does not obtain.

[xiii] One might object that conceivability would obtain even if only god or angels, or souls after death, were able to understand the nature of the universe. But the context of the quote militates against this interpretation. Leibniz thinks that he himself – a terrestrial human being – *positively* understands *that* Locke's view is unintelligible, and not merely that he does not understand it.

[xiv] An important part of this critique, though, will be that the inconceivability of the occasionalist hypothesis does is not grounded in an internal contradiction in the *idea* of occasionalism; rather, it is inconceivable that the occasionalist hypothesis would be *true*, in accordance with the principle of sufficient reason.

[xv] Indeed, Leibniz disagrees with Hobbes precisely on this point, stating that "Hobbes, who claimed that truths are arbitrary […failed to consider] the fact that the reality of a definition is not a matter of decision and that not just any notions can be joined to one another" (G IV. 425 = AG. 26).

[xvi] The same reductionism is present in the *Antibarbarus Physicus*:

> [I]n nature, things must proceed by steps, and one cannot go immediately to first causes. […] But if certain people, abusing this beautiful discovery [i.e. gravity], think the explanation given is so satisfactory that there is nothing left to explain […] then they slip back into […] the *occult qualities of the Scholastics* (G VII. 338-39 = AG. 314).

[xvii] That Leibniz identifies these two notions is apparent, for instance, when he writes in the *Principles of Nature and Grace* that, "A *composite substance* is a collection of simple substances, or *monads*" (G.VI.598 = AG.207), and in a letter to Des Bosses that, "Simple substances or monads are either intelligent or without reason" (G II. 438 = AG. 200).

[xviii] While part of the context of the above is Leibniz's engagement in a political endeavor (viz. he is attempting to persuade the Catholic Church to lift the ban on Copernicanism), I do not think we ought therefore to take his words here as insincere. Leibniz's attempt in the essay in question is grounded in a belief that we have every indication that he held wholeheartedly—namely, the relatively of all motion. Therefore, I think the above identification ought to be taken at face value.

[xix] This is further corroborated by some of Leibniz's other comments. For instance, in the *Antibarbarus Physicus* he calls the hypothesis of gravitation by means of a thread "more intelligible" than the primitive attractive force advocated by many Newtonians (G VII. 342 = AG. 318). Leibniz also describes himself as rehabilitating substantial forms "in a way that would render them intelligible" (G IV. 479 = AG. 139), thus implying not only that intelligibility admits of degrees, but also that something formerly obscure can, by an apt explication, *become* more intelligible.

[xx] "For Leibniz, it inheres in the very definition of truth that all truths are analytically true" (Rescher 2001, 149). "[Truth] is shown by giving a reason [for the truth] through the analysis of both terms into common notions" (AG. 98).

[xxi] On this construal, Leibniz need not hold that something is only an identity when each term can *salva veritate* be reciprocally substituted for the other, but only that the predicate term is always able to be replaced by the subject term *salva veritate*. For instance, Leibniz claiming that all truths are reducible to identities need not entail that the truth "Whales are mammals" is such that the term "whales" is always able to be replaced by the term "mammals" in a truth-preserving way (for then, for instance, it would be true that all mammals live in the ocean in their natural

habitat)—only the opposite of this (that everything true of mammals is also true of whales) need be true for the identity condition to obtain.

[xxii] Not, of course, *per se* more intelligible, but more intelligible to the person who is the dative of the explanation.

[xxiii] "God has chosen the most perfect world, that is, the one which is at the same time the simplest in hypotheses and the richest in phenomena" (G IV. 431 = AG. 39). "It follows from the supreme perfection of God that he chose the best possible plan in producing the universe, a plan in which there is the greatest variety together with the greatest order" (G VI. 603 = AG. 210). "And this is the way of obtaining as much variety as possible, but with the greatest order possible, that is it is the way of obtaining as much perfection as possible" (G VI. 616 = AG. 220).

[xxiv] I.e. because the same state of affairs could conceivably have been brought about by simpler means—*without* primitive attraction.

[xxv] "It was always one of [Leibniz's] paramount aims to avert a Spinozistic necessitarianism, and he regarded the contingency of the world's constituents and processes as an indispensable requisite towards this end, one in whose absence the idea of divine benevolence would be inapplicable" (Rescher 2001, 145).

[xxvi] Leibniz offers positive evidence for this claim when he states, for instance, regarding the identity of indiscernibles (ID), that "When I deny that there are two drops of water perfectly alike, or any two other bodies indiscernible from each other, I don't say it is absolutely impossible to suppose them, but that it is a thing contrary to the divine wisdom, and which consequently does not exist" (G VII. 394-95 = AG. 334). A world in which ID did not obtain would be less rich in phenomena, therefore less perfect, therefore less intelligible. Leibniz seems to imply that a world in which bodies attract each other is possible when he writes that "on the strength of what God can do, we would rant too much license to bad philosophers, allowing them those *centripetal virtues* or those *immediate attractions* at a distance, without it being possible to make them intelligible" (G V.54 = AG. 300-301). In the above passage, Leibniz implies that God *could* have created a world with centripetal virtues. In other words, such a state of affairs is possible. Cf. Rescher (1996).

[xxvii] G IV. 498; 520; 522; G VI. 540-41.

[xxviii] On this point, consider the following quote from the Theodicy: "If the effect were assumed to be greater, but the process less simple, I think one might say, when all is said and done, that the effect itself would be less great, taking into account not only the final effect but also the mediate effect" (G VI. 241 = H §208).

[xxix] The principle of sufficient reason plays a more important role than is generally recognized in Leibniz's physics. Leibniz uses the principle to deduce certain consequences which he takes to be certain—for instance, the existence of the plenum and the non-existence of atoms. Take, for instance, his comment that the existence of two identical bodies is "a thing contrary to the divine wisdom, *and which consequently does not exist* (G VII. 394-95 = AG. 334; emphasis mine). For Leibniz, metaphysics "becomes real and demonstrative by means of these principles [i.e. of sufficient reason and the identity of indiscernibles], whereas before it did generally consist in empty words" (G VII. 372 = AG. 328).