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PHIL 820

## **Metaphysical Foundations of Mechanical Philosophy in the Leibniz-Clarke Correspondence**

### 1. Introduction

“We observe that everything in the world takes place in accordance with laws that are eternally true, laws that are not merely geometrical, but also metaphysical, that is, not only in accordance with material necessities, but also in accordance with formal reasons.” (Leibniz, ‘On the Ultimate Origination of Things’, AG: 152)

In explanations involving physics, Leibniz was a staunch mechanist. He sought also to provide a firm metaphysical foundation for his mechanical philosophy. The essential topic of this paper will be to provide a basic outline of this metaphysical foundation and to depict how Leibniz’s commitment to his mechanist physics plays out in certain key issues in the Leibniz-Clarke correspondence. A key text in the Leibniz-Clarke correspondence involving the mechanical philosophy occurs in Leibniz’s fifth letter, where he states:

A body is never moved naturally except by another body that touches it and pushes it; after that it continues until it is prevented by another body that touches it. Any kind of operation on bodies is either miraculous or imaginary (L-C: 44).

Two words that immediately stick out in this text are the words natural and miraculous, and they are put at two opposing poles. These two words are both sore spots between Clarke and Leibniz, and frame much of the debate surrounding the mechanical philosophy in the correspondence. First I will give an interpretation of Leibniz’s metaphysical account of force and the principles of force or dynamics that makes up his natural philosophy. Then, we can be much better equipped with dealing with these problems as they appear in the correspondence. A central problem in the correspondence (highlighted in the text above) is that of gravity, and the room that Clarke/Newton might leave for the explanation of gravity in terms of non-mechanical forces. In the final sections of the paper I will discuss the problems that Leibniz and Clarke discuss in relation to God’s action in the world, specifically the way Leibniz encounters this problematic in his dialogue with Clarke on the issue of miracles.

### 2. The Metaphysical Foundations of Leibniz’s Mechanical Philosophy

Leibniz’s account of mechanical causation among bodies can perhaps be understood in an illuminating way with reference to two of his opponents, Descartes and the occasionalism of Malebranche. For, Descartes, the essence of bodies is extension. The essential properties of all bodies relate to attributes of their extension in three dimensions, such as outer shape, figure and size. According

to Steven Nadler, by reducing body to extension, Descartes removed the primary causal mechanism of Aristotelian physics (Nadler: 3). Motion is merely a modification of body and consists in the transference of the body from the immediate vicinity of a set of contiguous bodies to the set of another. For Descartes, physical causation is the transference of motion from one body to that of another, and this transference only arises through collision between the bodies. The stipulation that there is no such thing as ‘action at a distance’ is a principle that aligns Descartes within the mechanical philosophy, and this axiom is a tenet that Descartes and Leibniz will share.

If bodies lack a primary causal mechanism, and all motion of body is merely a mode of its essential being (extension) with the added condition that modes cannot be transferred between substances, Descartes faces the perennial question of locating where in fact the action or causes are coming from. Malebranche locates the causal mechanism in God. God is the general and primary cause of motion, and a body’s motion is that body’s recreation by God in different successive relative places (Nadler: 3-5).

Leibniz, against the Cartesians, holds that there is something over and above mere extension that constitutes the essence of bodies. In the *Discourse on Metaphysics* 17, he makes an argument against Descartes to show that “God always conserves the same force but not the same quantity of motion” (DM 17 Title). Here Leibniz presents Descartes as believing that God always conserves the same quantity of motion in the world. Descartes, according to Leibniz, believed that this quantity of motion (speed multiplied by the size of the moving body) represents or is an effect of the force that is conserved. Leibniz uses an example of two falling bodies, one of four pounds falling a quarter of the length of a falling one pound body and accepts two assumptions, granted by the Cartesians.

1. A body acquires the same force falling from a certain height as it took to lift that body to the same height.
2. An equal amount of force is required to lift a body of four pounds a quarter of the height that it takes a body of one pound.

On these two assumptions, again both granted by the Cartesians, the force acquired by a body of four pounds falling one meter will be the same as that of body of one pound falling four meters. It will also take the same amount of force to elevate the two bodies to their respective heights; therefore the quantity of force will be preserved. But Leibniz asks, will the quantity of motion (speed multiplied by the size of the moving body) be the same for the two bodies after they have fallen their respective heights? Taking a principle demonstrated by Galileo, the speed of the one pound body will only be twice as much as the speed acquired by the four pound body, even though the four pound body fell a quarter of the distance of the one pound body. Leibniz reasons that the quantity of motion of the one pound body will only be half that of the four pound body, even

though the quantity of force acquired will be the same. Through this example Leibniz demonstrates that the quantity of motion must be something different than the quantity of force.

The distinction between quantity of motion and force is important for Leibniz not only in establishing proper laws of physics, but also for metaphysics. If all of a body's properties were modifications of mere extension, then everything in physics could be explained on the basis of geometrical notions concerning the body's size, shape, position with respect to other bodies and motion. But Leibniz, in the example depicted above, hoped to demonstrate that in order to give a proper account of the nature of bodies some other principle must be established that is not derivative of extension, namely force. The special role Leibniz reserves for force are crucial in his account of the metaphysical foundations that his natural 'mechanical' philosophy derives. He states clearly:

The distinction between force and quantity of motion is important, among other reasons, for judging that one must have recourse to metaphysical considerations distinct from extension in order to explain the phenomena of bodies (DM 18, Title).

In discussing the notion of force, Leibniz also sees it as a way of defending the mechanical philosophy from claims of impiety. As we will see, the metaphysical basis of force will lie in something immaterial. Therefore the claims that the mechanical philosophy is impious for eliminating immaterial beings from the world can be quickly dispelled (DM 18).

Leibniz holds that the existence of force is something more real than that of extension. Extension is a relative concept, comprehended in abstraction, "a mere ideal thing, the consideration of which is nevertheless useful" (L-C: 47). This serves as another argument for Leibniz against Descartes. Since extension is a relative concept, it is not the sort of thing that can be an essence of anything. As Leibniz states in a letter to De Volder, "the unity of an extended thing lies only in its having been abstracted" (AG: 172). In determining what the unity of an extended thing follows from, Leibniz poses a new argument against the Cartesians, an argument that points the way to a notion of force as that of which body is grounded. Both Leibniz and the Cartesians grant that physical bodies are infinitely divisible. Therefore, a body like a chair is infinitely composed of smaller bodies. The chair is an aggregate of aggregates of infinitely divisible bodies. As Leibniz says rather poetically in the *Monadology*:

Each portion of matter can be conceived as a garden full of plants, and as pond full of fish. But each branch of a plant, each limb of an animal, each drop of its humors, is still another such garden or pond (M 67, from AG: 222)

However, as Leibniz makes clear in his letters to Arnauld, "where there are only beings by aggregation, there aren't any real beings" (AG: 85). Leibniz will not take the suggestion that the essence of body is to lack true unity, for that would make body's essence purely phenomenal, like rainbows or piles of stones. Again since extended bodies are by nature aggregates that are infinitely composed of

infinitely many aggregates, extension cannot constitute true unity for bodies. Leibniz states to Arnauld:

We must, then, necessarily come down either to mathematical points, of which some authors constitute extension, or to the atoms of Epicurus and Cordemoy (which you reject along with me), or else we must admit that we do not find any reality in bodies; or finally we must recognize some substances that have a true unity (AG: 85).

So since Leibniz rejects that we do not find any reality in bodies, he is lead to the conclusion that the substantial unities are found at an immaterial level. The units will be non-extended and indivisible. We find a similar argument to this in the sections of the *Monadology*.

There must be simple substances, since there are composites; for the composite is nothing more than a collection, or aggregate, of simples (M 2, from AG: 213)

But where there are no parts, neither extension, nor shape, nor divisibility is possible. These monads are the true atoms of nature and, in brief, the elements of things (M 3, from AG: 213).

The nature of these immaterial substantial unities deemed monads lay the foundation for the world of phenomenal bodies, such as chairs, trees etc. In order to further explicate this picture we must now turn to discussion of Leibniz's ontology of force.

#### 1. *Leibniz's Ontology of Forces:*

The account of force that I will give will draw heavily on the 'Specimen Dynamicum.' Leibniz opens this text by stating again that the existence of corporeal substances involves something over and above mere extension. There exists a force implanted everywhere in nature by the "Creator" that Leibniz calls 'conatus, or nisus' (AG, 118). A few sentences later in the 'Specimen', Leibniz, thinking perhaps of the occasionalists, specifies that although God produced the force in the corporeal substance, the force should not be attributed to God but instead constitutes the essence of substance ("to act is the mark of substance" AG, 118). A specific argument Leibniz develops against Malebranche appears explicitly in a letter to Lelong from 1712. Leibniz writes:

Force is one of the principal perfections, which being removed there will remain nothing of substance, or soon nothing at all. And I dare to say that without force, there will be no substance; and one will fall, despite oneself, into the opinion of Spinoza, according to whom creatures are only passing modifications. It is necessary, therefore, to say that God gives the force, and that he does not replace it, in order to preserve the substances outside of him (Quote taken from Rutherford 1993: 139).

If individual substances have no acting principle, and God is the source of all the action even after the moment of creation, then God remains the only substance,

and individual substances are reduced to modifications. Leibniz therefore makes the claim that Malebranche and the occasionalists fall into Spinozism. This argument will be important later as it appears again in a somewhat modified form in the Leibniz-Clarke correspondence.

At the basic level of Leibniz's physics exists an ontology of forces that arises from the essence or mark of substance being the power to act. The first type of force that Leibniz describes in the 'Specimen' is active force. Active force is divided into two types: primitive and derivative. Primitive active force designates the power inherent in substance qua substance. Derivative active force results from what Leibniz deems a limitation of primitive active force, and results from the collision of two bodies. A clearer explanation of the metaphysical basis of this picture comes out in a letter Leibniz wrote to De Volder in 1705. Leibniz writes:

I relegate derivative forces to the phenomena, but I think that it is obvious that primitive forces can be nothing but the internal strivings of simple substances (AG: 181)

Primitive force is what Leibniz calls in the 'Specimen' the first entelechy, which would later become what Leibniz would call the monad. Later in the letter to De Volder, Leibniz makes this connection between primitive forces and monads more explicit. Primitive forces are internal strivings of simple substances

by means of which they pass from perception to perception in accordance with a certain law of their nature, and at the same time harmonize with one another, representing the phenomena of the universe in different ways, something that must necessarily arise from a common cause (AG: 181).

We can see that this striving corresponds to what Leibniz would later call appetite in *Monadology* 15, and the description of the primitive forces representing the phenomena of the universe in different ways corresponds to *Monadology* 57. Derivative active force is found in many differing degrees, corresponding to the degree of limitations of primitive active forces. It seems that derivative forces in general are those that correspond to bodies. Leibniz in the text quoted above (from a letter to De Volder) stipulated that derivative force is that which corresponds to the phenomenal level, or the level of bodies. Bodies are though grounded on the primitive forces at the monadological level. Leibniz states though that since primitive active force corresponds to something essential in the substance, this type of active force can only explain general causation. On the other hand, derivative active forces, the modifications of primitive active forces, are sufficient to explain more "concrete" phenomena (AG: 119).

A second basic type of force designated is passive force. On a general level, passive force is connected to a certain resistance to change. It is this double element of force that Leibniz connects to his Principle of Sufficient Reason. This comes out clearer in a letter to De Volder. Leibniz here explains that things only change their states with a sufficient reason for change. Further on in the letter Leibniz writes:

But it is one thing to retain a state until something changes it...and quite another thing, much more significant, for a thing not to be indifferent, but to have a force and, as it were, an inclination to retain its state, and so resist changing (AG: 172).

A world without any resistance in body would be a world, according to Leibniz, of chaos. The resistance of bodies to changes in motion, that which slows a body when it comes into contact with another body, derives from passive force. It is by virtue of passive force that bodies have impenetrability and resistance. Passive forces are the causes of this type of behavior.

Just as active force was divided into two distinct types, there is also a primitive and a derivative passive force. Primitive passive force grounds the basic *resisting* or opposition to motion of a body. It is that tendency in the passive body that diminishes the force in the active body after acting upon the passive body. There is also a sense in which primitive passive force is the cause of a body's resistance (Garber 1995: 291). Leibniz writes in 'On Body and Force, Against the Cartesians' "that matter consists in the diffusion of resistance" (AG: 251). If the matter of body is simply diffusion of resistance, and resistance is grounded in the metaphysical notion of primitive passive force, then it seems that primitive passive force is that which enables matter to constitute a body. Primitive passive force is referred to by Leibniz at one point as *primary matter*. Derivative passive forces are different modifications of the primitive passive forces at the level of phenomenal bodies. They are referred to as *secondary matter*. So the picture that is emerging here is that derivative forces (active, passive) are limitations or modifications that are grounded at a substantial layer of primitive forces. Again, of most use to the physicist in explaining concrete and particular phenomena at the phenomenal level of bodies are the derivative forces. It is to this ontology of derivative forces that Leibniz's laws of action apply, "laws which are understood not only through reason, but are also corroborated by sense itself through the phenomena" (AG, 120).

Leibniz therefore was led to a consideration of forces after coming to the conclusion that there is something in body over and above mere extension. This consideration of forces leads to a grounding of physics on metaphysical laws. With these metaphysical laws and the laws of extension (geometry), the systematic laws of motion arise. In the *Discourse on Metaphysics* §21, Leibniz outlines that his and Descartes' differing metaphysical accounts of substance produce correspondingly different mechanical rules. If the essence of body consisted only in extension, the laws of motion could be derived on geometrical principles. According to Leibniz, these funky Cartesian laws of motion would produce a situation in which a smaller body would, upon contact, impart its own speed to a larger body without losing any of its speed. In contrast, Leibniz has decided to ground his physics on a metaphysics that corresponds to his notions of force. The metaphysical laws concern specifically notions of "cause and effect, action and passion" (AG: 125). We can see from Leibniz's analysis of forces that his goal is to account for fundamental substantial causes (primitive active force)

and the determination of the ground of body's resistances. The dichotomy of active/passive forces accounts for the acting of body and the resultant phenomena of a body being acted on. Splitting forces into derivative and primitive derives from Leibniz's principle that fundamental, individual substantial unities are immaterial. Leibniz's "systematic" laws of motion can be listed in the following way, from their appearance in the 'Specimen Dynamicum':

- All change comes about through stages.
- All action has a reaction.
- A new force is not produced unless an earlier one is diminished.
- Equal power in effect as in cause.

Force is composed of a certain activity or striving towards change, accompanied by a resistance derived from primitive passive force. That force is truly conserved (as opposed to quantity of motion) might account for the final principle.

At the core Leibniz accepts that all phenomena concerning bodies can be explained mechanically. However the mechanical explanation derives from the metaphysics of substance, and this metaphysics of substance derives from an account of the notion of force. Leibniz writes:

That is, we acknowledge that all corporeal phenomena can be derived from efficient and mechanical causes, but we understand that these very mechanical laws as a whole are derived from higher reasons (AG: 126).

The conviction that Leibniz is dedicated to is that mechanical explanations must be saved in physics. I have attempted to outline how Leibniz, through his account of force, provides the firm metaphysical grounding of the mechanical explanation that he thought Descartes and Malebranche lacked.

### 3. Leibniz-Clarke discussion

Now we will begin discussing the issues surrounding Leibniz's metaphysical foundations of his mechanical philosophy in the Leibniz-Clarke correspondence. In Leibniz's second letter in the correspondence with Clarke he discusses the relationship between the Principle of Sufficient Reason and the dynamic principles, or principles of force. Here Leibniz articulates his position that in contrast to mere materialists, metaphysical principles are needed instead of solely mathematical principles in order to do natural philosophy. The metaphysical principle he is referring to here is the principle of sufficient reason (PSR), "namely, that nothing happens without a reason why it should be so rather than otherwise" (L-C: 7). Leibniz states:

Now, by that single principle, namely, that there ought to be a sufficient reason why things should be so and not otherwise, one may demonstrate the being of

God and all the other parts of metaphysics or natural theology and even, in some measure, those principles of natural philosophy that are independent of mathematics; I mean the dynamic principles or the principles of force.

Therefore, this text presents Leibniz as stating that in some measure, the principles of dynamics or principles of force have a certain metaphysical backing. This corresponds exactly with our analysis above that Leibniz sees force as being the essence of all bodies at the metaphysical level. But what role does Leibniz reserve here for the PSR? In the third letter, Leibniz explains that “metaphysical principles concern more general notions, such as are cause and effect” (L-C: 14). We know, as mentioned above, that Leibniz also subsumed the notion of cause and effect as a metaphysical principle in the ‘Specimen Dynamicum’ (AG: 125). Leibniz gives a fuller explanation of the PSR in his fifth letter:

For the nature of things requires that every event should have beforehand its proper conditions, requirements, and dispositions, the existence of which makes the sufficient reason of such an event.

By determining the proper conditions, requirements for each event, we can be lead to determine the particular cause of that event. What are the proper conditions and requirements for a body to change motion? This leads us to Leibniz’s firm mechanical commitment to what he calls, in the essay ‘Considerations on the Principles of Life, and on Plastic Natures’, “the great principle of physics”: “that a body never receives change in its motion except by another by another body in motion which impels it” (S: 193). The important point is that Leibniz relates metaphysical principles in the correspondence to considerations of cause and effect. Considerations of cause and effect lead again to Leibniz’s metaphysical picture that rests on his account of force.

A key issue involving action and the conservation force appears in the correspondence when Clarke, in his third letter, states:

The active forces, which are in the universe diminishing themselves so as to stand in need of new impressions, is no inconvenience, no disorder, no imperfection in the workmanship of the universe, but is the consequence of the nature of dependent things.

Leibniz objects to this wholeheartedly. The consideration that active forces are diminishing, specifically in inelastic collisions between two bodies, violates his law of conservation of force. In his fifth letter to Clarke, Leibniz explains that “the forces are not destroyed but scattered among the small parts” (L-C: 59). Leibniz here states that he agrees with Newton that the quantity of motion is not conserved, but that the quantity of force is always preserved. This basic distinction between quantity of motion and force was presented earlier when Leibniz set out to prove that the notion of force served as the proper metaphysical grounds of physics (DM 17). An issue from the Clarke text that Leibniz takes even more offense to is what Clarke possibly means by dependent things. Leibniz sees the notion of diminishing forces in nature as being an impossible example



of an imperfection in God's work. For Leibniz there is no imperfection in God's work.

For none but God can give a new force to nature, and he does it only supernaturally. If there was need for him to do it in the natural course of things, he would have made a very imperfect work (L-C: 26).

Clarke in his response begins by stating that every action is the giving of a force from one body to another. Therefore Clarke is led to disagree with Leibniz, stating that if the giving of force is supernatural then every action by man and God is supernatural. For Leibniz any addition of force would be supernatural because it would be a violation of his conservation law: a new force is not produced unless an earlier one is diminished. Force is a notion that forms the essence of substance, and an act of creating force would fall outside the nature of substance. This leads us to a further discussion of what Leibniz means by supernatural in the correspondence, specifically concerning the problem of miracles.

In his third letter Leibniz states: "that which is supernatural exceeds all the powers of creatures" (L-C: 17). That which is a miracle for Leibniz explicitly is that which exceeds any power of a substance. On the other hand, Clarke views miracles as whatever occurs that is in some way irregular. Merely exceeding the power of nature is not miraculous for Clarke, for no action in God's view is more miraculous or natural. A miracle just consists in the unusualness of the action. A key text representative of this view occurs in Clarke's fifth letter:

I affirmed that, with regard to God, no one possible thing is more miraculous than another, and that therefore a miracle does not consist in any difficulty in the nature of the thing to be done, but merely in the unusualness of God's doing it (L-C: 82).

Leibniz finds this position utterly distasteful. If there really is no internal difference between a miracle and a natural phenomenon, then Leibniz claims everything fundamentally would be natural and miraculous. Leibniz goes one step further, and uses this conclusion to highlight that Clarke's position brings Clarke too close to the heretic Spinoza:

Will not this doctrine, moreover, tend to make God the soul of the world, if all his operations are natural like those of our souls on our bodies? And so God will be a part of nature (L-C: 62).

Leibniz in a sense is making a similar argument to the one he made against Malebranche. By claiming there is no fundamental difference between natural phenomena and miracles, Leibniz claims that Clarke reduces all natural phenomena to the action of God. God is the soul of the world, and all natural action is no different from divine action. In this piece of text Leibniz is hinting at the possibility that Clarke and his notion of miracles, could be reduced to Malebranche's occasionalism, and therefore to Spinoza.

The discussion of miracles really comes to a head though in the discussion of

gravity. The implication that gravity is an action at a distance would violate a fundamental principle of Leibniz's physics. The principle that Leibniz calls the "great principle of physics", namely: a body cannot change motion without coming into contact with another moving body. Leibniz makes this criticism explicit in Section 35 of his fifth letter, quoted at the beginning of this paper. Since action at a distance would exceed the nature of body, it must be something miraculous.

But then what does he mean when he will have the sun attract the globe of the earth through an empty space? Is it God himself that performs it? But this would be a miracle if there ever was any.

If Clarke reduces the functioning of gravity to some sort of attraction over a distance, Leibniz will take the position that Clarke is positing some sort of perpetual miracle. For from his metaphysics of substance, attraction or an inherent gravitation exceeds the powers of substance. Any sort of action that in the world that comes from outside the nature of substance, must be the result of God's activity.

In section 119 of Leibniz's fifth letter he notes that even if Clarke or Newton relegates the cause of gravity to immaterial forces, as opposed the action of God, this cause is still a non-mechanical explanation. He further insinuates that any form of explanation that is non-mechanical is unintelligible. This results from Leibniz's specific derivation of his mechanical philosophy from metaphysical grounds. An explication of Leibniz's derivation also helps to alleviate a tension that one might find in his account. A large part of the debate between Clarke and Leibniz on such things as active forces diminishing, miracles, and gravity centers fundamentally on their differing views on God's active role in the world. For Leibniz, God has made a truly perfect work that does not need mending, and he is continually making the criticism that Clarke's position leads to the view that God has made a world that continually needs mending. One might find a tension in Leibniz's account on the fact that he seems to be offering a very determinist picture, and at the same time he leaves room for miracles to occur. One key text that might help us out of this dilemma is found in the *Discourse on Metaphysics*<sup>16</sup>:

We must remember what we have said above concerning miracles in the universe—that they are always in conformity with universal law of the general order, even though they may be above the subordinate maxims.

By subordinate law Leibniz is referring to a law of nature (DM 17). Everything that we call natural depends in a certain way on these subordinate causes. Even though God gives us the ability to learn about the world, still our consciousness of the world must in some ways be finite. Our knowledge of the world could never equal the knowledge that God has of the world, even though our minds in some way mirror God's knowledge (M 83). When Leibniz states that miracles exceed the natural powers of bodies, he means that miracles exceed what we are able to call natural, namely the things that follow from the subordinate

maxims. God on the other hand, is able to understand everything in the most perfect way. Therefore, miracles can exceed the natural course of things, without limiting God's foresight in creating the world. God has created a perfect work, which needs no mending. Miracles do not fall outside of God's order in the world, but are outside of our particular understanding of the world through the subordinate maxims. This is the sense in which they exceed what is natural. Natural corresponds to our limited finite knowledge of the world through the subordinate maxims. God needs no subordinate maxims to understand the world, as he understands everything perfectly in its own particularity. On this interpretation Leibniz is able to alleviate the tension noted above.

This understanding provides us with an interpretation of Leibniz's remarks in section 120 of his fifth letter. Again, Leibniz states that an explanation of gravity as being caused by some immaterial substance would be a non-mechanical explanation, and therefore unintelligible. The unintelligibility of any non-mechanical principle is a result of the fact that the subordinate maxims, laws of nature, are mechanical. These are derived from what Leibniz takes to be a strong metaphysical ground. Our way of obtaining knowledge of natural phenomena is through the subordinate maxims, and anything that exceeds these maxims in nature is unintelligible. As miracles are unintelligible (DM 17), any non-mechanical explanation will be unintelligible. When Clarke says that the tendency of bodies towards each other is regular, constant and therefore natural, Leibniz retorts "it cannot be regular without being reasonable, nor natural unless it can be explained by the natures of creatures." The nature of creatures reduces to notions of force, which as we have seen, Leibniz explicates in order to ground his physics. Physical laws that result are purely mechanical, and action at a distance or the mediation of some immaterial substance as an explanation of gravitational attraction simply cannot do on a mechanical basis. Since attraction cannot be explained by the nature of creatures, it is for that reason rejected on metaphysical grounds. It would exceed the powers of creatures, and would therefore be unintelligible and miraculous.

#### 4. Conclusion

Hopefully, from gaining a proper insight into Leibniz's metaphysical foundations of his mechanical philosophy, certain stances that he takes on key issues in the Leibniz-Clarke correspondence appear in a clearer light. The issues from the correspondence explored in this paper are the conservation of force, gravity and God's activity/miracles.

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