Leibniz's Ultimate Theory

Soshichi Uchii

Abstract

This is a short summary of my new interpretation of Leibniz's philosophy, including metaphysics and dynamics. *Monadology* is the core of his philosophy, but according to my interpretation, this document must be read together with his works on dynamics and geometry *Analysis Situs*, among others. *Monadology* describes the reality, the world of monads. But in addition, it also contains a theory of information in terms of the state transition of monads, together with a sketch of how that information is transformed into the phenomena via coding. I will argue that Leibniz's program has a surprisingly wide range, from classical physics to the theories of relativity (special and general) , and extending even to quantum mechanics.

1. How should we read *Monadology?*

Among Leibniz's papers he completed in his last years, the one that should be regarded as containing the core of his system of knowledge is *Monadology* (1714). It is a theory of metaphysics, but I take it that Leibniz thought that it is the foundation of dynamics, and he envisaged that dynamics should be combined with his new geometry, called *Analysis Situs.*

There are two firm grounds for the preceding assertion. The first is that Leibniz sketched the relationship between his metaphysics and dynamics, in the two papers *New System* and *Specimen Dynamicum* (both published in 1695; English tr. in Ariew and Garber 1989). If we wish to figure out a reasonable interpretation of *Monadology*, this ground must be taken very seriously.

The second ground is the amazing accomplishments shown in *The Metaphysical Foundations of Mathematics* (written around the same time as *Monadology*; English tr. in Loemker 1969). *Monadology* was found from the large heap of manuscripts and published in 1720 by German translation. But very few scholars, since then, seem to have tried to read Leibniz's metaphysics together with his dynamics and geometry called *Analysis Situs* (this has been thoroughly studied by De Risi 2007). *The Metaphysical Foundations* contained many updated results of his geometry in conjunction with many important insights as regards the relation between metaphysics and geometry; and we can find even his attempt at unifying dynamics

and geometry. Here, we have to recall his famous saying that "everything is connected". Unless we try to understand his metaphysics in connection with dynamics and geometry, at least, we cannot obtain any good interpretation of Leibniz's philosophy.

I have come across Leibniz's philosophy in the process of examining the theories of space and time based on modern physics. Since then, I have spent a little more than ten years for my study of Leibniz. And only recently I have published a book on Leibniz, describing my own reading, called "Informational Interpretation of *Monadology*" (first appeared as Uchii 2009, and the updated version is Uchii 2016). The crucial idea of this interpretation is that we have to extract Leibniz's "theory of information" from *Monadology* and other texts. Indeed, I have found out that *Monadology* contained such a theory, since Leibniz had to connect his ontology with a theory of the state-transition of each monad, and also with mental and physical phenomena. Needless to say, he did not know the modern theory of information (in the 20th and 21st century); however, I will claim that his *Monadology* can be understood only in terns of the viewpoint and concepts of the theory of information. The present paper is going to show how we can obtain a better view, not only of *Monadology*, but of the overall structure of Leibniz's philosophy, especially as a philosophy of physics.

2. **The Theory of Monads presupposes Coding and Programming**

Already in *New System*, Leibniz said that each monad (simple substance) can be likened to a spiritual automaton, and it is governed by an internal force (primitive force) . This force is easily understood in terms of the state-transition function of a monad; alternatively, we may say each monad is programmed (by God) to work harmoniously with other monads, and changes its state (perception) accordingly. Further, in *Specimen Dynamicum*, he said that this primitive force (in a monad) is transformed into the derivative force in the phenomenal world. This statement can be simply translated as: the derivative force is a *coded* appearance of the primitive force. "Coded" because the primitive force belongs to reality (the sphere of monads), but the derivative force belongs to the phenomena, how the reality is *represented* to intelligent creatures like humans. In order to connect two entirely different spheres, we need coding. Further, notice that any monad's states (perceptions) themselves *represent* the whole reality, the sphere of the monads. Thus we have to assume at least two different systems of coding, one for states (perceptions, which occur in reality), another for phenomena. These must be *different*, because Leibniz consistently says that there is no space and no time in

reality whereas phenomena (including motion) occur in space and time (see Uchii 2015b, and for a concise presentation see 2015a). This is a crucial point for understanding Leibniz's metaphysics.

In any case, it is clear that in order to make sense of Leibniz's assertions about monads and phenomena, we have to conclude that he presupposed the notion of coding, despite the fact that he never used this word. And we have to further notice that *programming* is inseparable from coding. Take an obvious example of a Turing-machine. Any Turing machine (its state-transition vis-à-vis its tape) can be programmed but any such programs must be linked with coding, how a natural number is represented on the tape. Likewise, God, the ultimate programmer of reality cannot make any program without using some coding, and this is logically necessary.

3. T**he Range of *Monadology***

Many readers may wonder why we have to dig into Leibniz's philosophy which is quite old, at least 300 years old! For these skeptical readers, I will argue that Leibniz's program has a surprisingly wide range, from classical physics to the theories of relativity (special and general), and extending even to quantum physics. Thus his program should be quite instructive for many philosophers of science.

The reason why his philosophy can have such a wide range is easy to understand: the separation of reality from the phenomenal world, and connecting these two spheres by means of code, or we should say, by means of various systems of coding. The single monadic world (reality) is governed by the law of state-transition of each monad (programmed by God). And Leibniz consistently says this reality has neither space nor time, nor any quantities. But this reality can be represented (via coding) quantitatively in the phenomena, and thereby the law of the state-transition of reality can be transformed into quantitative laws; I say "laws" because any such representation in the phenomena is always *incomplete* and therefore a mere *homomorphism*, not any isomorphism. Thus for creatures with finite abilities such as humans, knowledge of the laws governing the phenomenal world should be partial, and not unified. Classical mechanics, special relativity, or quantum mechanics can at best represent partially the structure of reality. Although Leibniz had no knowledge of relativity theories or quantum physics, I am sure he would say as follows: these are different attempts at decoding God's coding and the law of reality; and because of incompleteness of any such attempts of decoding, unification of all of them is quite hard. Aside from incomplete data from the

phenomenal world, the difference and incompleteness of decoding become stumbling blocks for unification.

4. **Space, Time, and Dynamics**

Let us remember Leibniz's distinction among the phenomena: *well-founded* and otherwise. Phenomena are well-founded if there are their bases in reality. All right, what does this mean? Phenomena are coded messages from reality (the sphere of monads), but because of coding, not everything in these messages has a counterpart in reality. This is obvious also from the nature of coding which is, generally and mathematically, a homomorphism. Unlike isomorphism which is based on one-to-one correspondence between two spheres, homomorphism is only a partial correspondence; so that in these messages there can be many ingredients which have nothing to do with reality. Therefore, Leibniz emphasized that there must be, in a phenomenon, something that is representing some aspect of reality. Then, it is a well-founded phenomenon.

The preceding remark is crucial when we wish to consider space, time, and motion. How are they related with reality, the sphere of monads? We have to distinguish *space and time in which any phenomena occur* from the *bases* of them in *reality*. Leibniz talks about both spheres very often *in one breath*; and this misleads most readers. However, if we keep the preceding remark in our mind, we can easily come to the right answer. In reality (no space, no time), there are monads and relations among them. And within each monad, its state-transition is all given at once; there is the *order* of succession of states, which is not time but the *basis* of time. Likewise, monads are not in space, but there are various relations among them; or rather, since Leibniz says that organized groups of monads, where each group is governed by a single dominant monad (often called *anima*) , correspond to *natural machines (divine machines)* in the phenomenal world, the relations of these groups are the *bases* of *spacial relations*, and the totality of the latter is *space*. As De Risi's excellent work has clarified, Leibniz's *Analysis Situs* aimed at revealing the relationship between *Monadology* and the foundations of geometry, the mathematics of space.

Leibniz's message is clear: the basis of geometry is *qualitative*, although the geometry of phenomenal world is *quantitative* (that is, it is determined by what we now call *metric*). This clearly shows that any quantitative geometries are determined both by the *basis* in the monads and the *coding* from reality to phenomena. Of course we do not know God's coding, so that we have to guess by scientific method, such as Newton's assumption of absoluteness, or the 19th

century assumption of inertial system, or Einstein's special or general relativity, etc. All the same, Leibniz would say that these are attempts of *decoding*, i.e. trials of discovering the hidden coding. In short, in order to know the law of reality, decoding is indispensable, and this aspect of science is clearly *informational*. That's the point of my informational interpretation of *Monadology*. In passing, let me note that Julian Barbour's work on "Shape Dynamics" (Barbour 2011) shows a strong affinity with Leibniz's idea, although Barbour does not use the notion of code.

Then what can we say about motion and dynamics? It is well known that Leibniz subscribed to the mechanical philosophy, so that the science of motion, dynamics is most closely connected with the attempts of knowing reality. For that is directly concerned with motions of bodies, which should be representing, in the phenomenal world, groups of monads and the state-transitions of any such groups. The laws of motion must be regarded as representing the laws of state-transition of monads, via coding, in some way. This is clear from Leibniz's texts on dynamics, where he stated the correspondence of the *primitive* force (in monads) to the *derivative* force (in bodies). According to my interpretation, "derivative force" means "coded representation of primitive force," and I would claim this is the only sensible interpretation!

Now, if the preceding point is grasped, it is easy to understand why Leibniz's *Monadology* can provide a good *scenario* for unification of physics, even including the major branches of modern physics (general relativity and quantum mechanics). The bases of space and time, by themselves, are not sufficient for determining the structure of the space and time of the phenomenal world; in addition, we have to know the coding from these bases to specific metric for space and time, or space-time. This flexibility is amazing, and it comes solely from coding, and the reality is always the same! Thus according to Leibniz's metaphysics, best theories of physics through the history of science can be regarded as different representations of *the same reality*, despite the differences of conceptual apparatus among these theories.

In addition, Leibniz's metaphysics can suggest a way of unifying two or more incompatible theories, like general relativity and quantum mechanics. For, although they represent the reality in two incompatible ways, it may well be the case that this incompatibility is due to difference of coding. As recent developments of the multiverse interpretation of quantum mechanics show, there is a promising way to understand quantum theory as a *deterministic* theory (see , e.g., Wallace 2012 and Tegmark 2014). Leibniz's metaphysics has no difficulty for comprehending both *single reality* and multiverse *as its representation*; each component of multiverse seems indeterministic, but taken together, they are governed by a deterministic law

(Schrödinger equation), which may be at least a *partial representation (homomorphism)* of the state-transition of the monadic world. And if this picture is on the right track, the aim of our ultimate theory should be to find out *the whole program of the reality*, i.e., the law of state-transition of the monadic world. Although I do not think this is possible for humans, the dream of physicists presupposes such a possibility. In other words, if they insist on *realism and the ultimate theory of this reality*, the Leibnizian metaphysics should be among the candidates of such a theory. Further, let me point out that theory-changes as regards the "physicist's ultimate theory" can be easily handled at the level of the *representations (i.e. coded appearances)* of reality, not reality itself.

The crucial point of Leibniz's metaphysics is that it can provide (1) the basis of space and time, together with (2) the basis of the law of state-transition of the phenomenal world. We know neither, of course. But if we assume that there is the ultimate reality together with the ultimate program for the phenomenal world (multiverse), then we are coming closer to Leibniz's scenario.

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[For a more comprehensive bibliography, see the end of Uchii 2015c.]