Monadology and Music

Soshichi Uchii
(Kyoto University, Emeritus)

Abstract

In this paper, I will present an analogy between Leibniz's *Monadology* and musical works. A musical work is usually written down in a score. It is divided into many voice parts, and for every part, it gives all musical information necessary for performance. Now, since any such score specifies all notes of that musical work, at once, it can be regarded as atemporal; musical time does not flow in a score. And it does not specify spatial relations among the voice parts. Thus, the musical work described in a score exists as an informational entity. A score is a kind of "program" for playing. This program contains invariant structures, and such structures define the identity of the work. On the other hand, it allows freedom for performers. Any performer has to "interpret" the work, and his or her performance is an expression of that interpretation. Any such interpretation may be regarded as a kind of "coding" for transforming the specified invariant structures into actual sounds in space and time. This dual aspect of musical works is the basis of my analogy. It should be conducive to improving our interpretation of *Monadology*.

1. Basic Features of *Monadology*

In my recent papers (Uchii 2009 and 2014a, b, c), I have developed my own informational interpretation of Leibniz's *Monadology*. In order to take a quick look at these, the reader is referred to the Synopsis of the whole work at the end of Part 3 (Uchii 2014c). Now, most recently, I have found that a fine analogy holds between Leibniz's monad and a voice part of a score. This analogy may help those who still have difficulties with *Monadology* or with my informational interpretation. That's the reason why I add this short paper, as a new item in this group of my papers.

Now, let us briefly summarize a number of essential features of *Monadology*. The grounds of my interpretation are fully explained in my four papers cited above. The reader may also consult Richard Arthur's excellent and up-to-date exposition of Leibniz's philosophy (Arthur 2014); although his view and terminology may be somehow different from mine, it is quite useful.

(1) All monads are created by (rational) God.

(2) The world of monads is governed by the Pre-established harmony.

(3) The world of monads is without space.

(4) The world of monads is without time.

(5) Each monad changes its state (perception) according to its own distinctive transition function (according to my interpretation), and the whole sequence of its states is given at once (Uchii 2014a, sect. 1)

(6) The unity or individuality of each monad is defined by its sequence of states (in other words, by its initial state and its transition function and both are given by God).

(7) Monads are organized into many groups, each of which is governed by a single dominant monad, called *anima* or *entelechy*. And such groups are again organized into a nested structure, *ad infinitum*. The whole is a single world, ultimately governed by God (Uchii 2014a, sect. 12).

(8) There are many invariant structures in the world of monads. Most important is that the information is conserved, and for each monad, the order of state-transition does not change. As a consequence, the order of world-states does not change either, where a "world-state" is a conjunction of all the states of monads with *the same order* in each sequence (Uchii 2014b, sects. 20, 21).

(9) The activities (i.e., state-transitions) of these monads produce phenomena (appearances) for each monad. N.B., that phenomena are quite different from states, since there is a distinction between well-founded phenomena and others. I have adopted the notation for this, and expressed a state by *R(W)* and a phenomenon by *Ph(W)* , where *W* is a world state, *R* signifying "representation (perception)", and *Ph* signifying phenomenon (Uchii 2014a, sect.1 (3), 2014b sect. 21).

(10) The genesis of phenomena, which may well be different depending on the grade of monad, depends on God's coding. That is, the same world state *W* may well appear differently to humans and to angels, for instance. Likewise, the perception *R(W)* of a monad should be different so that, to be exact, we need a subscript for *R* and *Ph*; but for the sake of simplicity we will ignore this (Uchii 2014b, sects. 21, 27).

(11) Further, notice that the *quantitative* features of phenomena, including the magnitude of space and time (in other words, length and duration) must be generated by God's coding of *Ph*, by preserving the invariant structures of the monadic world. According to my interpretation, no other elements of *Monadology* can be responsible for this job (Uchii 2014b, Sects. 23-27. For a

possible way out from Leibniz's difficulties for constructing dynamics on monadology, see Uchii 2014c).

These eleven features are sufficient for our present purpose.

2. Voice Parts of a Score

Now, let us turn our attention to music, and see the relationship between a musical work and its actual performance. Any musical piece is good for our purpose, but take a music score for an orchestra. Usually, it is a bulky book containing all of the information for every part (called voice part) to be played by a designated instrument, such as violin, violoncello, flute, horn, percussion, etc. This is one of the typical musical works. But what *is* a musical work, in the first place? Obviously, it cannot be the same as any single performance, since a single work can be played many times by different performers.

Here, we find a quite similar problem with which Leibniz has struggled. Namely, what is the condition for establishing *individuality* and *uniqueness*? Obviously, in view of (6) of Section 1, the right answer should be: "the musical information prescribing what notes, and how, one should play." But this is a kind of program, *a program for playing.* Although it is not as rigid as a program for computer, it is rigorous enough for specifying what notes players should produce (preserving the prescribed proportions among the notes), and how their notes should be correlated with each other. Recall (8) of Section 1. Any musical work, Bach's Orchestral Suite Nr. 2 (BWV 1067), for instance, has *invariant structures*, but it allows some freedom for the player; e.g., the tempo can vary, the rhythm may be soft or succinct, the sound may be softer or sharper, etc. In a word, any musical work allows a room for the player's *interpretation*. That's one of the reasons why there can be so many good performances as well as mediocre or bad performances.

And we now come to the crucial point. A score for an orchestra can be regarded as a description of a musical work, as an existence without space, without time, but with essential invariant structures. Not a mere "description" but it should be regarded as a "program," thus those invariant structures can be regarded as *informational*, in the sense that the theory of information is applicable to it. In a word, any musical work is an informational entity, not a bunch of sound or tones which occur in our physical world. On the one hand, a musical work *exists* independently from space and time; on the other hand, many and various performances of that work *appear* in our physical world with space and time.

This already suggests a rough analogy between monads and voice parts of a musical work. A single voice part corresponds to a monad, and its relation to the whole work is analogous to a monad's relation to the whole world of monads. But in order to extend this idea, we have to take a closer look at the relationship between a musical work and its actual performances.

3. Interpretation and Actual Performance

The player has to preserve the invariant structure of the musical work, but there are still many things the player can change at his or her discretion. And this pair of invariance and freedom is the core of our analogy between monadology and music. First, notice that the *order of the notes* of any voice part of a musical work must be preserved on any interpretations of the player. For instance, any flutist, in Bach's Suite 2, must follow the specified sequence of notes, and keep the right proportion among these notes. Likewise, the specified *correspondence between any voice parts* must be preserved as well; otherwise, the intended *harmony* may be destroyed. This harmony is a kind of *pre-established harmony* by the composer (comparable to (2) of Section 1). Thus, the flutist and other players are required to adjust appropriately their tempo and tones with each other, despite their freedom to choose (within a reasonable range) the overall tempo. And, if the orchestra becomes as large as our modern versions, a conductor is needed for *unifying* the performances of many players (see (7) of Section 1).

Now, in order to unify many voice parts and many players, what should the conductor do? He or she has to decide the *spatial relations* of these voice parts. Such relations are widely left open, and usually no instructions are written in a score. Although customs or cultural traditions may be working in most cases, the conductor should have final words on this matter. For, it is the conductor who is responsible for deciding the *interpretation* of the musical work to be played; and this includes deciding *spatial* arrangement, as well as the overall *tempo*, and moreover any changes (if necessary) in detail, of performance.

For instance, if we may take Bach's Suite 2 (mentioned above) as an example, flute is given a very important role in each movement (comparable to the soloist of a concerto). Then, some conductor may want to give flute a salient position close to the center of the stage. And the conductor may listen to the flutist's opinion as to the tempo of their performance. Or else, if the conductor is like the famous Toscanini, he may decide the tempo by his own interpretation, even against the composer's instruction! There is a story that when Toscanini played Ravel's "Borélo," in Paris, the composer himself was among the audience. After the concert,

the story goes on, the composer visited the conductor, and complained that the tempo was faster than the composer's intention. But the conductor Toscanini replied, "I can play it only with that tempo!" There are several versions of this story, and I do not know whether it is correct. The point of this story may be that the conductor has the final word on his own performance.

Thus it is easy to understand that such spatial and temporal arrangements are an important part of the conductor's (or some players') *interpretation* of the work. In a word, as regards this performance on the stage, on this occasion, s*pace and time* (of this performance) *depend on* the conductor's *interpretation*.

And notice that, since the order of all notes is already given in the score (as a part of invariant structure), it is the *quantitative aspect of time* that must be decided by this interpretation. In the language of mathematical physics, this aspect is called *metric*. Likewise, spatial relations among voice parts are also given in terms of *spatial distance* (*metric*) together with geometrical arrangement, which are exactly similar to what Leibniz called *situations* (*situs*). Recall (11) of Section 1. The voice parts are *situated* in any prformances, and each note of a voice part is also *situated* among each of the whole performances; thus the progression of the tune is like a *change of situation*, i.e., a *motion* in phenomena. And the source of the *quantitative* features of these must be the *interpretation*.

Now we can see the power of our analogy. Some important features of *Monadology* can be nicely reproduced in terms of the musical work and its performance. The musical work itself (as an informational entity) is like the world of monads, and each voice part is like a single monad. A musical phenomenon is nothing but each actual performance of the work on the stage. That performance takes place within space (an arrangement on the stage of all voice parts, and depending on it, spatial arrangements of all tones including their changes) and time (tempo of the performance, based on the order of notes in the voice parts), and spatiotemporal metric depends on the conductor's interpretation. The last point diverges from feature (10) of section 1. But notice that the conductor's interpretation includes a sort of *coding* from the "order of notes" to "quantitative spatiotemporal metric" of the actual performance. Unlike *Monadology*, our analogy in terms of musical work must divide the role of God into two, the composer and the interpreter. Despite this discrepancy, the informational aspects of *Monadology* are well preserved.

The most important features of this analogy are summarized in the following Table.

4. Summary Table

	Leibniz's monad	voice part
Who designs and creates?	God	Composer
Pre-established harmony	Yes	Yes
Space	Non-existent	Non-existent
Time	Non-existent	Non-existent
State transition	All states ordered by a transition function or program	All notes ordered or programmed by composer
Individuality, unity	comes from each transition function, informationally unique	comes from each series of notes determined by composer
Groups and organization	Infinite hierarchy among infinite groups	Finite and organized parts, and each part contains finite ordered notes
Invariant structures	The order of state-transition, and relations with other monads	The order of notes and relations with other parts
Phenomena produced	Physical and mental events and processes	Actual performances by musicians
Relation to phenomena	Mediated by God's coding	Mediated by the interpretation of the performers (players controlled by a conductor)
Quantitative features of phenomena	generated by God's coding	generated by the player as an interpreter

Table. Monads and Voice Parts

References

Arthur, Richard (2014) *Leibniz* (Classic Thinkers), Polity Press, 2014.

Uchii, Soshichi (2009) "An Informational Interpretation of Monadology." *Logic, Methodology and Philosophy of Science, Proceedings of the 13th International Congress* (ed. by C. Glymour, Wang Wei, and D. Westerståhl), pp. 344-353. (also, PhilSci-Archive 4635)

Uchii, Soshichi (2014a) "Monadology, Information, and Physics Part 1: Metaphysics and Dynamics." PhilSci-Archive 10599

————- (2014b) "Monadology, Information, and Physics Part 2 (revised): Space and Time." PhilSci-Archive 11088

————- (2014c) "Monadology, Information, and Physics Part 3 (revised: Inertia and Gravity." PhilSci-Archive 11125

(For a larger Bibliography, see Uchii 2014c.)