NO-BOUNDARY EMERGENCE AND BOOK OF CHANGE[1]

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ABSTRACT. *This work attempts to respond to Thomas Aquinas' Cosmological Argument in a way that combines Set Theory with the idea of the 'Book of Change'. The study defines the i^{th} Cause Set on which to operate on, which leads to the ontological commitment of austerity that the 'First Cause's Compromise with emergence' cannot be avoided. It is argued in the present paper that the concept that 'emergence only consists of Synchronic Emergence and Diachronic Emergence' should be extended to a broader notion of emergence, which is made up of the two discussed elements and a third one 'No-Boundary Emergence' (beyond the time dimension). The article defines the concept of No-Boundary Emergence, proves why it is a type of emergence that differs from the traditional two types, and asserts that it underlies the bottom layer of the cosmos. This study describes the common feature of all emergence as communication protocols between layers. The assemblage of all emergences behaves similar to a distributed system that cannot be restricted by Gödel's theorem. The paper provides evidence (in Big Bang Cosmology, Conformal Cyclic Cosmology, Superstring Theory, Quantum Gravity) for this point of view, and notes that emergence (in the context of No-Boundary Emergence) is not only a simple scientific theory but also a progressive scientific research programme that can spontaneously grow from scientific theory based on Platonism at the expense of a degenerating shift to the ontological commitment of austerity. This paper proposes an improved model of Schrödinger Cat that provides a new explanation for quantum measurement and argues that there must be a forbidden zone of thought experiments. The study also introduces the implications of ancient Chinese thoughts (namely, the 'Book of Change' and Confucius). The paper comes to the conclusion that emergence (crossing the gap between 'being' and 'nothing', while ignoring the forbidden zone of thought experiments) relieves 'cosmological insufficiency' in the sense of Neo-Aristotelism.*

KEYWORDS: *Aristotle, Big Bang, Book of Change, Cosmology, Emergence, Hawking, No-Boundary, quantum measurement, research programme, Schrödinger*

[1] This article is funded by the Nation Social Science Foundation of China (Program number: 14ZDB171).
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Contents

Introduction

Emergence, as in the title of the paper, which was initially utilized to develop a type of integrated philosophy, refers to 'the whole before parts' and came into being during the period of debate between Vitalism (in Aristotle's sense) and Mechanism in the 19th century. A lot of scientific philosophers believed that the philosophy of emergence is able to unify human knowledge.

Emergence [Goldstein 1999:49 & O'Connor 1994:92, 93] makes sense both ontologically and phenomenologically [Johnson IV 2013:284]. Emergence appears differently in theories to explain the characteristics a whole system has. However, there is something common: namely, emergent properties cannot be logically predicted from the parts. Emergence is often studied in the spheres of consciousness and biology, but not in that of cosmology.

Indeed, emergence has been classified into two categories: Synchronic Emergence [Stephan 2002:78] and Diachronic Emergence [Havlík 2015:132]. Both of these categories of emergence refuse to go beyond the time dimension.

Essentially, Jaegwon Kim developed the theory of emergence which claims that emergence cannot be deduced and '*downward causation*' is the basic principle of

emergence [Kim 1999:19]. This criterion can be considered the primary criterion to judge whether there is emergence in a system.

1. PRELUDE TO THE COSMOLOGICAL ARGUMENT

Some scholars think that Aristotle's thought is far from modern science because the explanation of internality in vitality (Aristotle's energy) has been replaced by one of externality in mechanical force, which is often considered a metaphor of Aristotle's failure in physics as well as significant support for the notion of 'an estranged real world which is utterly divorced from the world of life' [Koyré, 1965:23].

1.1. Aristotle's Thought and Newton Mathematics

Newton's work on physics was more like a substitution than a revolution (more like mathematics than physics). In his book *Mathematical Principles of Natural Philosophy*, there is not an explanation about the cause of force, but description about the form of force, which is no cleverer than Aristotle's point of view. That is why the concept of force was criticized by contemporary physical scientists. Furthermore, in Galileo's work, nothing was put forward as new content metaphysically that was different from Aristotle's thought [Koyré, 1966:232].

In Aristotle's sense, 'the stone falls because it is made of stone which is a kind of earth'. This explanation has an internal source of behavior [Aristotle, 2006:90] that was lost by Newton. Indeed, Newton's scientific theory describes only how the universe behaves, not why it behaves in that way. Thus, it is not conducive to understanding the cosmos.

For mankind, one regrets that there are now two paths (with blinkers) towards the same goal, but they are separated by walls, so there has been little attempt to join all forces to achieve the goal [Schrödinger, 1954:11, 12]. One path is modern science, and the other is metaphysics. In ancient Greece, the system of knowledge did not have this type of division [Schrödinger 1954:14]. Thus, returning to ancient thought is necessary [Schrödinger, 1954:3]. Scientists should learn from ancient thoughts (not only ancient Greece, but also ancient China).

Thus, to some degree we need a regression to Aristotle's thought at a higher level (for example, '*Neo-Aristotelism*') to understand the world of life, as well as that of the cosmos. To balance Platonism (on which modern science is based), we also need integrating theory (for example, emergence) that will benefit the '*Neo-Aristotelism*' and Platonism.

1.2. Thomas Aquinas' Cosmology Argument

Scientific philosophy has also caught up in the debate between realism and antirealism, even leading the philosophy of science to the edge of nihilism.

From Mario Bunge's standpoint, it is not a good choice for scientists to answer philosophical questions in the way that is inappropriately reductionist, for such polarized views are a sign of early human perspective [Bunge, 1977:75]. A certain number of philosophers also believe that it is necessary for scientists to recognize the autonomy of high-level theories when establishing scientific theories [Li, 1995:8].

Therefore, the discussion makes sense in the scientific world only when it is focused on a deflationary construal from an ontological commitment of austerity. In particular, the ontological commitment of austerity has to be able to explain the majority of the phenomenon and the creation of the universe, in which space, time, the First Cause and interactions among them cannot be avoided.

In modern cosmology, the Big Bang theory indicates the existence of singularity wherein the equations of gravitational field cannot be defined at some points in the history of the universe, pointing to General Relativity's failure in explaining the beginning of our universe. As a result, Big Bang theory posits that it cannot predict anything in our universe, which means that an arbitrary initial state resulted in an arbitrary current state. As we know, in Quantum Theory, there is a principle that everything will happen if not absolutely forbidden. If the creation of our universe were determined by a singularity, the Big Bang would occur at any time, which makes it clear that the predictability of world would disappear. If the law of physics fails in the singularity, it will fail in any place.

Science is supposed to provide knowledge about the local laws governing the revolution of universe. Revealing how the universe began is an issue of metaphysics or religion, wherein there is a well-known argument from design for God's existence proposed by Thomas Aquinas whose first three ways are proverbially considered cosmological arguments [Reichenbach, 1972:5].

Essentially, as far as we are concerned, causation can be regarded as the key point of his view. He claims that nothing can cause itself. Accordingly, every object has a cause. However, the existence of an endless string of objects causing other objects is absurd to imagine (the thought can be originally derived from the discussion of 'infinite' in Aristotle's book *Physics*), which means that there must be a first cause. Thus, the Design, God, the Mover or the First Cause can be defined as the one who caused the chain of existence for all things.

In the Big Bang theory, as a matter of fact, it is the physical law that determines the progress of 'being' being generated from 'nothing'. Nevertheless, Kant thought that as a pure form of intuition, space and time are the background of thinking, rather than content or an object. Thus, although the basis of Kant's Philosophy is retorted by General Relativity in a manner, it still implies the failure of humans' cognitive abilities, not only in the physical world, but also in philosophy. The singularity is something similar to the First Cause, which would be a dreamy lunacy in Metaphysics.

2. FROM FIRST CAUSE TO EMERGENCE

The major result of Thomas Aquinas' Cosmological Argument was bringing about the First Cause of everything, which is thought of as the beginning of the universe and the conscious mind, rather than an object in the sense of epistemology. Thus, the First Cause can only cause effects; it cannot be caused as an effect. The First Cause, which is the cause of other causes directly, or indirectly, can influence other objects and events, but not vice versa.

2.1. Definition of Second Cause and ith Cause Set

Obviously, in our opinion, the argument can be analyzed in two distinct but logically related steps.

First, a cause named *C* may be the effect of a combined action between cause *A* and cause *B*, both of which has nothing to do with each other. That is, *A* is not the cause of *B* directly or indirectly, and vice versa, and it is the collection of element *A* and element *B* that plays a role in causation as a whole.

In light of the above, we have a new approach in Set theory to defining any cause. According to the idea, a cause can be probably defined as a Set that is a collection of elements, such as events and laws. Thus, the First Cause can be understood as First Cause Set (hereafter called the *1st* Set), which contains only elements that can cause other elements while not being caused by others. Moreover, originating in a point, representing any element in the *1st* Set, the causation will be traced as an arrowed line outward. The elements in *1st* Set cannot be affected by any elements out of the set, which means it cannot be reached, epistemologically. In spite of this, the elements in the *1st* Set can determine any other elements out of the set (directly or indirectly, alone or jointly).

A second cause and a third cause are needed for the logic string, if there exists a first one and a last one. Therefore, we can use an ordinal number *i* to mark any of the causes that can be defined continuously until a number *N*. Although *N* cannot be infinite (Thomas Aquinas), it can be very large. In this way, the definition of the *Nth* cause is formulated.

2.2. First Cause's Compromise with the Second Cause

The section pertains to the analysis and operation of Thomas Aquinas Cosmological Argument in concept combined with Set Theory and the *Book of Change*, but it is a bit bothersome. If readers do not specialize in these fields, they can skip it. This section will pave the way for proposing a viewpoint of the First Cause's compromise with emergence ontologically.

Based on the two steps that are mentioned in the section above, from the *1st* Set definition, the Second Cause is converted into a Second Cause Set (hereafter referred to as the *2nd* Set), which we can deduce as a collection consisting of all the elements that elements in the *1st* Set directly pointing to. Thus, the elements in the *2nd* Set can refer not only to objects and events in the real world, but also to concepts in the mind, such as causes, principles and laws, which are not absolutely refused by human's abilities in thinking, understanding and linguistic logic.

What is more, all arrowed lines of causation from points (representing elements) in the *1st* Set point to ones in the *2nd* Set by definition. That is because originating in a point (representing any element in the *ith* Set), the causation will be traced as an arrowed line outward and we assign *1* as *i*, the state of the *1st* Set is achieved.

In other words, there is no *ith* Set (where the ordinal number *i* is larger than *2*) that consists of elements pointing directly from elements in the *1st* Set. As a matter of fact, the *2nd* Set will be the only way through which lines can pass.

We find that all elements in the *2nd* Set contribute to affecting all other elements

beside the collection of the 1^{st} Set and 2^{nd} Set. In addition, it is obvious that the 2^{nd} Set can be seen as a collection of elements that are generated somehow by certain elements in the 1^{st} Set (perhaps some that act as generators and other that act as laws).

However, the elements in the 1^{st} Set (whether they exist or not) that are suspected to be the ultimate causes of everything, are transparent (the transparent feature of emergence will also be mentioned in *chapter 3*) to any of the elements except those in the 1^{st} Set and 2^{nd} Set. For instance, the elements in the i^{th} Set (i is larger than *2*) cannot feel the influences made by those in the 1^{st} Set directly, such that 'the 1^{st} Set' is an unnecessary assumption for 'the elements in the i^{th} Set' epistemologically and ontologically. If we use graphics to illustrate this, all the arrowed lines of causation from the elements in the 1^{st} Set pass through the 2^{nd} Set. In this case, we can put the elements of the 1^{st} Set into the 2^{nd} Set completely? This involves the following issues.

Which cause is more fundamental or ultimate, the First Cause or the Second Cause? Whose ontological commitment of austerity is closer to the philosophical presuppositions of the Big Bang theory? Are the First Cause and Second Cause separable strictly? Is there an explanatory gap between the two? Are there fundamental differences between the First Cause and Second Cause ontologically?

Next, we will show the analytical procedure to the questions above.

Obviously, the width of the natural gap between the First Cause and the Second Cause epistemologically (and ontologically), is determined by the possibility that elements in the First Cause Set can be cognized.

Remarkably, when the i^{th} Set is defined, the number of its elements cannot be constrained. There was no point to that approach!

All the elements from all of the Sets create the 'cosmos tree' (which is something similar to a tree, but not exactly, because there is no guarantee that there is only one root node) of causality, wherein we can discover the relationship between any two elements more clearly.

When the node (element) in the tree has only one ancestor, it can be easily placed into a different set. When the node X has two ancestor nodes (Y and Z), there are three possibilities:

First, one ancestor node is the ancestor of the other;

Second, one ancestor is closer to the common ancestor W of the two (Y and Z);

And lastly, neither of the two is the ancestor of the other, and neither is closer to the common ancestor.

In the latter two scenarios, we have at least two types of classification for the elements of Cause Set. If we separate W and X into two Sets (for example, the i^{th} Set and $(i+1)^{th}$ Set), there is no standard logically to tell us why Y belongs to the i^{th} Set while Z belongs to the other. We cannot base this decision on the distance between the node (Y or Z) and the common ancestor W. (Attention! As we declare, to say 'the node W is the common ancestor (of Y and Z)' is only a relative and temporary concept, which is introduced only when the discussion starts. It cannot be a series or fundamental concept!)

A node can be connected with the common ancestor or with the common

descendant node, which leads to a different definition of the i^{th} Set. We cannot easily delimitate the i^{th} Cause Set by trees of nodes representing elements logically. Thus, we can conclude that there *at least* exists an element in the i^{th} Set that is probably of the element in the $(i+1)^{th}$ Set, unless it is an element presented by a node of only one parent node. We cannot affirm that there is no element node having more than one parent node, because if we do that, the Set of the elements must be divided into massive Sets, the quantity of which can be the quantity of the elements in the original Set. *Through investigations and operations on the elements in the First Cause Set, the concept of the First Cause entity disintegrates ontologically.*

Similarly, the First Cause Set, or at least part of it, can be integrated into the Second Cause Set, which is probably a breakthrough of Thomas Aquinas' Cosmological Argument, ontologically and epistemologically.

If there is more than one type of classification method of the elements, in some ways, the First Cause can be finally deduced by the Second Cause ontologically [Sun, 2014:118]. In that paper, we provided the way (Inspired by *Book of Change*) to prove that *the operation of transformation from the general definition of the i^{th} Cause Set to a narrow one can also lead to the First Cause's Compromise with Second Cause*.

In general, we find that the First Cause is not an indivisible entity, but a set consisting of elements that can be operated on in different ways (containing the way of operation of the ***Book of Change****)*. Furthermore, there still is something that can be separated from the collection called the First Cause.

William E. Carroll from the University of Oxford made a presentation called "Cosmology, Metaphysics, and the Origin of the Universe: From Stephen Hawking to Thomas Aquinas" at Beijing Normal University on November 13th 2015, wherein he illustrated that a 'singularity' cannot be concluded as the absolute beginning indicating creation(as we see, it should be understood that the First Cause has something more than a 'singularity', i.e., the First Cause is a collection rather than an indivisible atom), which provides evidence of my point of view that the First Cause should be the set consisting of elements which can be operated on.

To understand this, we have to concentrate on the structure of the tree of nodes, as well as the aspect of the feature of the elements.

2.3. Second Cause Coincidence with Emergence

What does the Second Cause refer to in the actual Physical World? In our point of view, it can refer to emergence, and it is concluded without question that all the basic needs of the minimized ontological commitment of Big Bang theory could be satisfied [Sun, 2014:120].

Let's go back to the physical world.

Actually, Einstein's General Relativity described a four-dimensional image, which illustrates that individual components are insufficient to interpret the nature of relativity. In contrast, geometrical properties must be introduced on a larger space-time scale, which is a reflection of 'the whole before pasts'. In addition, it is worth mentioning that getting over 'cosmological insufficiency' [Khroutski, 2014:7] is, in a sense, very enlightening.

Is it a phenomenon of '*downward causation*'? Not exactly! However, it probably is an embryonic form of that! In this paper, we will eventually arrive at the point of view that the universe is a system of '*downward causation*'.

General Relativity, as the most powerful tool on researching the evolution of our universe, implies an idea of 'the whole before parts', which is a characteristic of emergence (not a necessary and sufficient condition, but the necessary condition).

According to Hubble law, the recession velocity of a galaxy is in direct proportion to the distance from the earth. Obviously, based on a series of derivations, several conclusions are inevitable. Everything in the universe occurs as a product of cosmic evolution, such as galaxies, atoms and molecules. Essentially, space-time also behaves as a product of the evolution, and the emergence of characteristics in the system of cosmos grows gradually in every stage of the cosmic evolution, which means space-time is proven to be an emergent property. Thus, it serves as a reference for the idea that 'the whole before parts' can be used as a candidate ultimate law of the universe.

In addition, more and more science theories implicate emergence as an ultimate law that can fundamentally explain the cosmos.

3. WHAT NO-BOUNDARY EMERGENCE IS

The ghost of the First Cause remains in the Big Bang model. The universe is expanding at exactly the critical rate to form atoms and galaxies, while avoiding collapse again [Hawking, 1996:51].

3.1. Emergence in Stephen Hawking's No-Boundary Proposal

The evolutions of universes vary from boundary condition to boundary condition. Consequently, a key point is that the First Cause can be paraphrased as the choice problem for the boundary condition. However, No-Boundary Proposal (Hawking's) indicates that "over all compact Euclidean metrics, the path integral for quantum gravity should be taken", which can be understood to mean that "the Boundary Condition of the universe is that there is No Boundary" [Hawking, 2010:79].

Essentially, with the means of introducing an orthogonal imaginary time, *the method of getting around the difficulty of singularity*, over all compact metrics, takes a historical path integral for quantum gravity, wherein the calculation covers the cosmos outside the universal horizon and the evolution process of universe acts as a quantum process specified for the Schrödinger equation. Thus, it will connect half a Euclidean four-dimensional space with half a de Sitter space, which can easily describe the interpretation models of cosmological inflation as a tunnel effect that generated the expanding universe [Hawking, 2010:80–103].

Figuratively speaking, the universe of the No-Boundary Model with imaginary time is something similar to the earth with latitudes and longitudes in which we will find no particularity at the poles representing Singularity.

The No-Boundary Proposal enables a Wheeler–DeWitt equation (*without time derivative*) that *crosses the gap* between the two ends (one with the existence of time,

and the other without that), yielding the Schrödinger equation of the evolution of universe, which can be considered an emergent property in the system of cosmos.

This approach provides an emergence approach to the problem of the First Cause, which means that emergence (as the Second Cause) goes beyond time, just as the First Cause does. We can define No-Boundary Emergence as the Second Cause, which generated time and all other objects after that. Very close to the creation of cosmos, time cannot be defined in General Relativity, which means No-Boundary Emergence is 'earlier' than time itself, or exactly, No-Boundary Emergence is beyond the time dimension.

The Emergence theory developed by scientists and philosophers contains only two types (Synchronic Emergence and Diachronic Emergence, hereafter called traditional emergence), both classified with the time dimension, which means emergence is something *in the time dimension*. However, No-Boundary Emergence is obviously something beyond time [Sun, 2014:120]. The conflict between No-Boundary Emergence and the traditional ones seems irreconcilable, unless we reclassify emergence, with one type beyond time, called No-Boundary Emergence, and the other type in the time axis, called traditional emergence (which includes Synchronic Emergence and Diachronic Emergence).

Now, we know that, as the Second Cause, No-Boundary Emergence differs from traditional ones. The other question is whether No-Boundary Emergence is emergence. If it is true, No-Boundary Emergence is proven to be a new type of emergence. Can we go further?

3.2. No-Boundary Emergence Underlies the Bottom Layer of Cosmos

Einstein once posed the question of whether God has more than one choice in creating the universe [Hawking, 2012:165]. If No-Boundary Emergence is only the Second Cause, God is *still free to choose* the universe. However, something stops him.

Indeed, it is worth noting that, there is a great philosophical shift from the book *Nature of Space and Time* to *The Grand Design*, in which Hawking suggested that 'the universe is free to generate itself from nothing, but when the universe is already a being, substances in it are not free to generate itself', which balances the positive energy (in the form of mass and speed) and the negative energy (in the form of gravity) to keep the total energy of the universe always *at zero* [Hawking, 2012: 179,180]. Thus, the universe is either an organic cosmos with something similar to consciousness preventing new substances from generating themselves, or an emergence with a power of '*downward causation*' (that is why No-Boundary Emergence is emergence).

As we see, it is because there is *only one* '*choice*' (Occam Razor would take effect on it if there is only one) for God (if he is still here). Thus, the 'only choice' is most likely determined by *No-Boundary Emergence* ***as the First Cause***. If all of these are true, there is *no anthropic principle, fine-tunings in laws, or apparent miracle*, all topics that have tormented scientist for decades.

However, what is No-Boundary Emergence (as the First Cause) like?

Emergence is probably *a series of elements* similar to *a Distributed System* that cannot be restored to a deeper exclusive law, rather than something similar to M-theory, which is quite different from what Hawking believes.

Notably, the ***Distributed System of emergence*** cannot be described in an axiomatic system; that is, it will *never be restricted by Gödel's theorem*. Furthermore, it only helps different layers communicate with each other, which is similar to what network protocol does between the physical layer and the data link layer. At the same time, it *is transparent to* the objects and laws on the upper layer, which explains why emergence is usually criticized as a type of mysticism or anti-reductionism by its opponents.

In summary, as far as we are concerned, ***No-Boundary Emergence*** *underlies the Bottom layer of cosmos* [Sun, 2014:120].

3.3. More Implication of No-Boundary Emergence in Modern Physics

Roger Penrose elaborated a related thinking in his book *The Emperor's New Mind*. He claims that a substance in which the atoms were arranged to appear as crystalline, will *never have a property of fivefold symmetry* [Penrose, 1991:435], which is not determined by experience, but *by the inevitability of Mathematics itself* (only a few 'choices' for God).

In addition, Penrose developed a further point of view in the book *Cycle of Time*, in which he provides insight into ways the entropy began with *a minimum value* (in a balanced state) but ends in a maximum value (*also* in a balanced state). In his opinion, if singularity can be ignored, (*the problem of singularity has already been solved in the previous sections*), this can be explained by the expansion of the Universe (it is also 'the whole before parts' and '*downward causation*'). The increasing Product Space [Penrose, 2010:32–34] (the product of phase space in a coarse-grained region and the external phase space, which will simplify the model) will provide *more variable room* for the entropy of all cosmos to occupy. In return, the two states are different in the dimension of the Product Space, because significantly more dimensions of Product Space will be produced in the future. Thus, entropy can be explained as one of the emergent properties from the evolution of cosmos system. As we see, *entropy is not ultimately used to define the direction of time in a cosmological sense*. Obviously, it illustrates that No-Boundary Emergence underlies the Bottom layer.

Essentially, regarding *the exact meaning of time*, a thought from 'Conformal Cyclic Cosmology' (the following referred to as CCC) [Penrose, 2010:137] enriches our understanding, using the method of Conformal Geometry (something similar to the three types of uniform plane geometry, as illustrated by Maurits C. Esche) to *connect the singularity* of Big Bang *with infinite* 'Heat Death' (Penrose is opposed to the designation). Penrose believes that it will not be endless that the 'Heat Death' in the distant future will last ontologically and epistemologically [Penrose, 2010:139–149], which is quite different from what most of the scientists believes.

Indeed, the precise definition of time is based on earth's rotation, atomic vibration or energy-level transitions, all of which can be considered clocks. Thus, we

can imagine the Model of CCC ontologically, as a story of 'Sleeping Beauty'. A beautiful princess has just woken up in her castle from a '100 years' of sleep (during that period all the animals, clocks, winds, clouds and stars fell sleep with her). How can she know anything about how long she has slept? All the existence around her cannot tell her anything. Furthermore, if all the cosmos fall into sleep, who is awake to record the passage of time? Penrose demonstrates with his theoretical model of CCC that there is no particle awake as a clock in the distant future when black holes have completely evaporated and all the particles have decayed into photons.

Obviously, the definition of time is not eternal because its faster speed in the distant future is *as* '*real*' *as its inexistence* in the narrow moment after the Big Bang (time is an emergent property in the evolution of cosmos), which means 'CCC' provides strong evidence to No-Boundary Emergence.

Surprisingly, we discovered that conflicting theories such as Big Bang and CCC can share the common ontological commitment of No-Boundary Emergence, which illustrates that No-Boundary Emergence underlies the Bottom layer (the philosophical assumptions of Big Bang and CCC).

4. EMERGENCE IN CONCEPT WORLD

It seems that philosophers are not good at foreseeing events in the sense of experience. However, if emergence is realistic in the real world, it has the ontological commitment of austerity, as well as meaning in science. Actually, a progressive scientific research programme should at least have excess empirical content over the degenerating one [Lakatos, 1989:31].

4.1. Progressive Scientific Research Programme

Emergence, in our opinion, ought not only to be considered as a specific quantified theory but also to be regarded as a scientific research programme. In the field of astronomy, Dark Matter is usually considered a new type of particle, or a new type of basic action force (as fundamental as the electromagnetic force, gravitation, the strong force and the weak force). The latter explanation, as we see, is not fundamental enough to answer what Dark Matter is. As a result, we cannot stop here. Dark Matter is more likely to be a result of the structure, which is determined by '*downward causation*'.

Thus, Dark Matter (Dark Energy as well) can be considered emergence, which can unify the four basic action forces, Dark Matter and Dark Energy as six different crystal facets of a Polyhedron.

There are already signs that the Dark Matter's proportion differs from distance to distance (from the earth), which means Dark Matter evolves in different stages of the cosmos (scientists know that the farther into space we observe, the more ancient the sky is).

Cosmos change their governance by promoting Dark Matter or Dark Energy in different stages to ensure that the evolution of the cosmos would be a certain way. In the first moment, the tremendous Dark Energy satisfies the needs of the Inflation model well, explains the origin of the large-scale structure of universe, and makes our

universal horizon distant enough. Then, in a sufficiently long time horizon, the cosmos evolves into a picture where Dark Matter has been promoted as the ruling class. Currently, the cosmos has to speed up their expansion once again to avoid the possibility of the Big Crunch. This seems similar to a Feedback Mechanism of the cosmos system, which is absolutely not accidental from the viewpoint of *the Grand Design* (Hawking's). However, we explain it as No-Boundary Emergence.

If this phenomenon can be fully confirmed, it will be a correct prediction by ***No-Boundary Emergence****, which will be proven to be a progressive scientific research programme*.

4.2. Spontaneous Growth in the Concept World

Emergence also exists in the evolution of series of scientific theories, which occurs as a type of *spontaneous shift* from series of scientific theories to series. It is a shift between two scientific research programmes in Lakatos' sense.

For example, according to Thomas S. Kuhn's book *The Copernican Revolution*, the earth's motion from Copernicus' point of view should be considered the by-product of planets' problems rather than a fundamental hypothesis of theory [Kuhn, 1985:144], which is a revolution of Methodology in spite of the one of Ontology. In fact, the two models are mathematically equivalent.

Accordingly, the gap (between two sets of theoretical system) is not as wide as people usually think. Indeed, *a spontaneous shift* (which seems to be a result of a new ontological hypothesis) between two scientific research programmes can take place in a broader perspective from history, making the ontological commitment more of austerity.

A spontaneous shift as an emergence often acts as if it is an accidental product of an idea of genius. Nevertheless, the shift effectively has *the inner cause*.

For instance, between the Early 20th and Late 19th Century, there was a set of theories consisting of Galileo symmetry, Lorentz transformations and Maxwell's Equations, which were not consistent unless one of the three is abandoned.

The vast majority of scientists and philosophers believe that what Einstein did was to *extending Newton's theory to a broader notion* wherein objects can move near the speed of light, which means Einstein *added something to* Newton's theory.

However, extending the field of science is not what Einstein really did. Essentially, the facts prove otherwise. *One can easily discover that extension in science is actually deflation in philosophy*. Extension is not addition but subtraction. *Einstein just abandoned Galileo symmetry and kept the combination of Lorentz transformations and Maxwell's Equations.* Then, a revolution in science took place.

That is why we believe that scientific progress is *at the expense of a degenerating shift to an ontological commitment of austerity, although it is not caused by the expense*. However, from a more macro sense, there is *only one 'choice'* for the growth of the scientific research programme, that there must be *a direction* that is not a fundamental property but an ***emergent*** property of *spontaneous shift in history*.

Einstein believed that Special Relativity will also be discovered without him. It

can be understood that the system of scientific theories consists of a logical incompatibility among the three (Galileo symmetry, Lorentz transformations and Maxwell's Equations), which *forced* Einstein to make a decision whether to use his aesthetic intuition to propose a Constant Speed of Light and the Principle of Relativity.

This indicates a new content of emergence outside the real world, which can be called ***Theory Emergence***.

*Emergence can be regarded as Naturalism (a series of elements similar to a Distributed System) of Foundationalism (**No-Boundary Emergence** as basic belief underpinning others).* After much analysis and many examples, we discover that for scientific theory based on *Platonism, the closer to the pinnacle it is, the closer to the opposite (emergence) it will be*.

Emergence (contains *No-Boundary Emergence*) can be considered as a ***new cosmology*** that is absolutely different from that of Platonism, and also as a *new trend* or *direction* as an emergent property in the evolution of series of shifts between scientific research programmes.

The extra spatial dimensions of *Superstring theory* is *not crumpled up in an arbitrary way* because the geometrical forms they can choose are severely restricted by the equations of Superstring theory. In fact, research (by Philip Candelas, Gary Horowitz, Andrew Strominger and Edward Witten) showed that there is only a particular class of six-dimensional geometrical shapes that can satisfy the conditions prescribed by the equations [Greene, 2003:207].

However, the number of nine space dimensions determined by mathematical formalism to avoid nonsensical probability values is so particular that *nobody can reveal an intuitive answer* in a nontechnical way without calculation [Greene, 2003:203].

In Superstring theory, the sphere inside a Calabi-Yau space shrinks down until the Planck scale, when continuing to shrink means starting to expand in the mirror world [Greene, 2003: 267], wherein force and matter transform into each other, and exchange the parity of dimension [Greene, 2003: 244,245].

Obviously, in the scientific research programme of Superstring Theory built on Platonism, there is still no hope to appropriately enduing the preference for a particular number with meanings to explain why the choice of Calabi-Yau space should be governed by this form of the equations.

In Superstring theory, the ontological problem in interpreting the particular choices of Calabi-Yau space is actually the problem of the First Cause, which connects the microcosmic worlds with the cosmoscopic universe. As we see, the answer is easily explicated in No-Boundary Emergence.

There is also *a possibility of spontaneous shift* (based on the evolution of series of scientific theories themselves) from a degenerating scientific research programme to a progressive scientific research programme in world 3(in Karl Popper's sense).

However, the spontaneous shift to progressive scientific research programme is often at the expense of a degenerating shift to the ontological commitment of austerity.

5. IMPROVED MODEL OF SCHRÖDINGER CAT

The Delayed-choice Experiment is explained as the 'integrity of system of observation apparatus' or 'participatory universe inspired by consciousness', all of which can be imagined as the 'future determines past' in the sense of Platonism. What is it like in the sense of No-Boundary Emergence?

"We can only observe and operate on the record rather than on the quantum world." said Shantena Augusto Sabbadini, professor at Schumacher College, when he discussed with us during his lecture at Yinhe SOHO in Beijing on October 31, 2015.

As we see, the experiment can be explained by the '*downward causation*' (not only in the space dimension, but also in time dimension) *in the sense of No-Boundary Emergence*. The cosmos is emergence from the relationship between the observer and the quantum world. Further, quantum measurement does not collapse the wave function, but prepares an entangled state of the observer and quantum world. What's more, consciousness is nothing special in quantum measurement, and '*observing on*' *is nothing more than 'communicating with'* (*we consider the observer as a normal object without consciousness*). That is to say, quantum measurement prepares an entangled state of the observer system and quantum world system.

As a result, *Cosmos is nothing more than* '*emergence from the relationship between two entangled quantum systems*'. Fortunately, this can be verified by experiments.

5.1. Three Boxes, Men and Cats

The model of the Schrödinger Cat from our standpoint is talks only about the question of 'Are observers witnesses or murderers?' We (Sun Sheng) proposed an *improved model of the Schrödinger Cat*. In the thought experiment, there are three *equal* (the relationship is *different* from the Schrödinger Cat model's relationship between *observer and object*) black box A, black box B, and black box C, inside of each of which we put a cat and a man (with a gas mask to ensure that he remains alive). From A to B, there is an observation hole (the man in A can make his decision to observe the cat in B through it at any time), and vice versa. This situation also applies to B and C (also C and A). Thus, we have three boxes, three cats, three men (observers), three bottles of poison, three hammers, three particles that can decay or not, and six observation holes (each pair of boxes has two holes, for example, A to B, B to A), *but no consciousness beyond the three to observe from God's perspective*.

For a man in a certain box, the state of the cat in the same box is certain, but he does not know whether his box has been observed by others. So far, this is a model that exhibits some sort of symmetry.

Man A knows (also '*determines*') the state of Cat B, after observing Box B (for example, he gains the information that Cat B is *dead*). If man C observes Box B, what will happen? Man C learns the state of Cat B, which *is already determined before his observation* although it is not known by man C.

We all know one of Einstein's two basic assumptions of the Special Theory of Relativity is that 'None of the inertial frames has special status in the form of mechanics laws [Blagojević, 2002:4].' This can be called the democracy of inertial

frames. In some ways, it is a fundamental belief in physics. Not considering scenery outside the window, someone having just woken up in a maglev train cannot be aware of its state of motion (whether it is moving or parked). The key point is 'how can you know that?' which is similar to the situation we face to account for timing in the story of *'Sleeping Beauty'*. However, scientists always forget the belief when facing the quantum world. How can you know whether the state of particles we are going to observe has been already observed by another consciousness that is separate from our universe (in another Box) and does not pass any information to us until to be observed?

Does the distribution of the measurement results acts as scientists expected? Or is it controlled by the man (in another Box) as a hidden variable or as God (he always observes earlier than us)? Who cares!

5.2. Forbidden Zone of Thought Experiments

There is a *paradox*: Unless we believe the second step 'man C observes Box B' is essentially 'man C observes the new quantum system consisting of Box A and Box B'. However, the new belief is probably the reality of the quantum world.

If we abandon the ontological commitment of 'there is an Absolute Observation that can collapse wave function', we can easily find the deflationary construal that '*observation can only be defined between two independent quantum systems*', which means '*the observation is entangled states preparation of the two independent quantum systems, rather than quantum collapse*'. *Thus, there is no special status of consciousness in quantum measurement that can be understood as* '*establishing contact with the other*'. It is something similar to 'observation is communication between subject and subject' (this is John Cobb's point of view on quantum measurement, when he discussed with us in 10th International Seminar on Bio-cosmology). *However, my explanation has nothing to do with subjectivity.*

Further, in philosophical terms, Box B is an independent quantum system that can be considered *another universe separate from us*, and makes no 'sense' (in the sense of Friedrich Ludwig Gottlob Frege) to us. A 'Description' cannot be without a 'sentence' (a 'sentence' cannot be without 'sense') when we can *operate only on record* (in Sabbadini's sense), which is a description rather than reality. Thus, Box B cannot be operated on. If something has *no* '*sense*' to us, it has *no* '*reference*' (in Frege's sense) at all.

Or, perhaps more accurately, we're not sure if we can observe, or if we can know what we will observe. The thought experiment is based on a black box that is so particular that it perhaps never existed. Accurately speaking, there is a contradiction that the isolation refuses any access to information but allows observation, which is a bit such as the 'Almighty' God. 'Almighty' has a logical contradiction. For example, 'is he capable to produce a stone that he cannot pick up?'

Indeed, we will not prove the similarity of the two here. Logical contradiction does not consequentially occur in images that 'cannot be imagined' such as a 'circular form in the shape of square'. We can conclude that not all the situations that we can imagine are situations with coincidence logic. As a result, we come to the

conclusion that there must be some *forbidden zone of thought experiments* in the sphere which is farther and farther from *the experienced world* (closer and closer to *origin of cosmos*).

Thus, if we cannot do it in thought experiments, what can we do?

Research from Mark Van Raamsdonk proved my viewpoint that if all the quantum entanglement disappears between two areas of a universe, they will become two independent universes that have nothing to do with each other [Van Raamsdonk, 2010:22–24]. *Thus, you cannot operate on the other area of space if you make it a box as black as you can imagine, because it goes away without leaving a message about the new address and you cannot find it*.

In his article, he notes that the universe structure is emergent from the quantum entanglement. His paper supports my point of view that there is *a forbidden zone of thought experiments*, and also provides evidence that ***No-Boundary Emergence*** *is the origin of the cosmos whereas No-Boundary Emergence underlies the* ***Bottom layer of cosmos***.

That is to say, ***No-Boundary Emergence*** *is even more fundamental than quantum entanglement which builds the Cosmos in which we live.* In the next chapter, we will show its explanatory power in other areas.

6. LEARN FROM ANCIENT CHINESE THOUGHTS

We all know that many famous scientists learn from ancient Chinese thoughts.

For instance, famous physicist Niels Henrik David Bohr was enlightened by Tai Chi, which was used in designing his family crest. John von Neumann's binary computer system was also inspired by Tai Chi.

Scientists began to believe that the relationship between 'human and cosmos' is similar to that of 'wave and ocean', which can be explained as 'from the same origin but with different names' in Taoism [Sabbadini, 2012:8–10].

6.1. Book of Change for Play

Operation (the paper used on 'First Cause Set') is the basic idea of quantum theory, as well as the basic idea in the *Book of Change* (which is often considered to be written by *Fu Xi* before 5000 B. C. in China, Edited by *Ji Chang* before 1056 B.C.), known as '*I Ching*' or '*Yi Jing*', wherein there are only two elements representing *Yin* and *Yang*, which is generated from *Tai Chi* (which is slightly different from *Dao*).

Most scholars in China believe that the *Book of Change* is not only mathematics or arithmetic, but also the cosmology of ancient Chinese thoughts (we know ontology and cosmology are the same in ancient China).

Why is the *Book of Change* difficult to read? The *Book of Change* is based on the concept that 'cosmos is based on *pattern* and *operation*', which cannot be understood as calculation or methodology. It is something for human ***to play****, to see, to feel and* ***to operate***, but *not* to calculate, or to read. The *Book of Change* can help humans operate the world as well as predict the world.

'*Hetu Luoshu*' (as one of the earliest thoughts in China), an invincible weapon

that can defeat all devils (however powerful) in legend, is a magic square of cosmos that can operate all the cosmos and generate all substances, operating different *digits* (1/0) to different *positions*, such as *metal*, *wood*, *water*, *fire* and *earth*.

'Han Zi' (Chinese character), which is pictographic and ideographic, is operated from the *Book of Change*, and it is usually believed to be a simplified '*Hetu Luoshu*', which many celebrities have tattooed to their bodies to get lucky.

Go (game) is produced in this type of view. It is regarded as the most difficult chess game. Even now computer cannot reach the level of world champions against human players. What can you *feel* in *Go* (game)? You can *feel* something similar to Combat between two martial arts masters; you can *feel* countless changes among *Yin*, *Yang* and *hexagrams*; you can *feel* how *Heaven* and *earth* work.

Remarkably, the correspondences of *positions* and *hexagrams* generated from operations are not arbitrary, as supervised by *Dao* (it generates *Yin*, *Yang* and *hexagrams*). From our standpoint, emergence is something such as the power of generating in Taoism, where ***No-Boundary Emergence*** is something similar to ***Dao*** in the *Book of Change*, generating Real World (*Yang*) and Concept World (*Yin*).

Indeed, the *Book of Change* provides an ontological commitment, as well as arithmetic in the methodological sense. However, it is quite *different from Pythagoreanism*, because it focuses on what the relationship between positions and operations means rather than the ontological implication of the digit itself.

In general, the *Book of Change* is a strategy for humans about *how to play in cosmos*, which can also inspire our understanding of ourselves and cosmos. The *Book of Change* accesses operation on the First Cause, which is the basis of the proof procedure (in *chapter 2*) that demonstrates what role No-Boundary Emergence plays. The approach is not easily classified as Naturalism or Foundationalism. Perhaps it can be understood as *a two-sided coin*: one side is in the tradition of Naturalism, and the other is in the tradition of Foundationalism.

*The **Book of Change** informs us that the operation on the First Cause Set is not only a methodology but also an ontology, which means the argument of the First Cause is no longer tenable ontologically if the concept of the First Cause Set is disintegrated methodologically*.

6.2. Chinese Confucius Thought

The importance of the relationship is emphasized by *Confucius*.

To answer *Yan Yuan*'s (one of his students) question of what '*benevolence*' is, *Confucius* stated, "*Self-restraint and restoration of rites are benevolence.*" We (Li Jianhui) discovered that '*benevolence*' is an *emergent property* from '*rites*' rather than from 'Intelligent Design' (by God or by Kings), which ought to be the *relationship between two individuals* (also between individuals and nature).

Regardless, we should learn from China, especially from ancient Chinese thoughts, such as the *Book of Change*, Taoism and Confucianism. In fact, the three are just the tip of the iceberg of ancient Chinese thoughts, with huge buried treasure.

Conclusions

Emergence should be considered in the sense of *Neo-Aristotelism as a third pole of Cosmology* that can *relieve* '*cosmological insufficiency*', as well as balance Platonism.

Emergence is the Second Cause, as an approach to solving Thomas Aquinas' Cosmological Argument, in a way that combines with Set Theory and the *Book of Change*.

Emergence, as a series of elements similar to *a distributed system* that *cannot be restricted by Gödel's theorem*, includes our newly founded item, called ***No-Boundary Emergence***, which *underlies the Bottom layer* of cosmos.

Emergence is also a *progressive scientific research programme*, which can *spontaneously grow* from scientific theory based on Platonism.

There is still *a forbidden zone of thought experiments* closer to the origin that can be explained as No-Boundary Emergence.

Emergence can be regarded as the *Foundational Naturalism*.

Predecessors' discussion on the First Cause is all about the relationship between *Θεός* and *λόγος*. If it were limited to the two poles in one dimension, the explanation would be mysterious or mechanistic. Fortunately, *in the presence of No-Boundary Emergence*, emergence is *third pole* that can provide a new dimension to *balance* the two.

No-Boundary Emergence *generates a Real World and Concept World* whereas *Dao* in the ***Book of Change*** generates *Yang* and *Yin*. We can learn more about this by studying the *Book of Change* and other ancient Chinese thoughts.

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