

# FROM CLASSICAL MECHANICS TO EMERGENCE: AN ALTERNATIVE TO PHYSICALISM AND REDUCTIONISM

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**ABSTRACT.** *The great achievement of physics as the basis of modern science makes it easy for people to think that the field of scientific knowledge is infinite, but the process of restoration of scientific success is difficult to re-brilliant in complex systems. The Relative to physicalism and reductionism, the emergence becomes another way to try to answer the problems that the physical science is difficult to explain. However, due to the differences of focus area and emphasis, the current academic circles do not make a consistent expression in respect to emergence. Therefore, it is necessary to revive the scholarly issue of emergence and sort out its history and its core content, so as to conduct a relatively accurate description of the current ideas of emergence.*

**KEYWORDS:** *emergence; physicalism; dualism; reductionism*

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# ОТ КЛАССИЧЕСКОЙ МЕХАНИКИ К ЭМЕРДЖЕНТНОСТИ: АЛЬТЕРНАТИВА ФИЗИКАЛИЗМУ И РЕДУКЦИОНИЗМУ

Цзингуй ХЕ и Аже ДЗЕЙЮЕ

**РЕЗЮМЕ.** Великое достижение физики как основы современной науки позволяет людям думать, что область научных знаний бесконечна, но процесс восстановления научного успеха трудно переосмыслить в сложных системах. Относительно физикализма и редукционизма, эмерджентность становится еще одним способом попытаться ответить на проблемы, которые трудно объяснить физической наукой. Однако из-за различного отношения к акцентированию внимания и приоритетным исследовательским областям, нынешние академические круги не уделяют должного внимания вопросам эмерджентности. Следовательно, нам необходимо восстановить значение этого научного вопроса и разобраться в истории его появления и современного основного содержания, так чтобы провести относительно точное описание текущих идей эмерджентности.

**КЛЮЧЕВЫЕ СЛОВА:** эмерджентность; физикализм; дуализм; редукционизм

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### Заключение

## Introduction

The understanding of the world and the questioning of being are of vital importance to mankind, and the track of this understanding and questioning is always accompanied by our own experience. In other words, our own environment and our understanding of science, history, and self-consciousness will be taken into our subject itself as feelings and become a key point to the understanding of ourselves and the world. No matter which position we tend to, we are inevitably from this position to explain the world with our feelings. Physicists believe that the existence

of all things are formed by the physical entity, therefore, all the explanations should be in accordance with the path of micro-physics interpretation. The dualists argue that humans, and like other creatures, are composed of their physical parts and minds, egos or spirits. The matter and spirit are two independent entities that can be irreducible to each other and exist in their own respective different fields. The interpretive mode of physical science is feasible and effective in a particular system. But the inadequacies of the ability of interpretation would gradually reveal when the interpretive scope is extended to the complex system. It is noteworthy that, we are currently moving into a new era of social history, and our world shows an organic, dynamic and holistic world-picture in many aspects, such as economy, politics, culture and society. However, for now, modern science and philosophy still remain in the dualistic field. Therefore, we urgently need a three-valued logic to adapt to the three-dimensional nature of contemporary culture and scientific development [Khroutski, 2017]. Emergence, in contrast to the dualistic logic in modern times, represents a new kind of cosmology that seeks to depict the overall nature of the complex systems and attempts to explain the problems that physics cannot answer.

### **1. A concept of emergence: emerged from the debate**

It is clear that the emergence is not a monolithic term, and the ideas about emergence are suspected by some scholars. Physicists believe that things like "mind" could not exist in the physical world. They deny the possibility of experiencing the mind in the physical world. The dualism holds the opposite view: the mind or the spirit could not emerge from material, because the mind is essentially different from the material, and the concepts like the soul, the spirit or the God could not possibly be produced from material. Thus, their conclusion is that the theory of emergence is destined to fail.

But we should notice that the physicists are just out of our experience and act as a conscious agent in the world. However, mankind not only has the experience of thought, will and choice, but also we continually experience the reality of these ideas and wills – they are manifested as causality in the world. Dualism only to a certain extent weakened the connection between the central nervous system and the state of consciousness, but it could not completely eliminate the connection between the two. In addition, physicalism and dualism are still facing many urgent questions that are hard to answer: where is the mind in nature? Could the mind fully understand the content of the natural and scientific world? How is it possible to connect the emergence of the mind and the transcendence of the mind? Both dualism and physicalism did not give us a complete answer. But these questions are very important that every philosopher need to ask. Emergence provides us a new and more productive paradigm that would help us to trace and clarify the problems that have been suspended before, and in this way leading us from physics to the mind and going transcending.

Emergence theory has always rejected the way of physics and dualism to explain the world, it uses the novelty and unpredictability as its own basic attributes. Novelty and unpredictability are important features of emergence, which are naturally

produced in the interactions in nature. This means that these emerging structures, organizations and ideas could not be reduced to the subsystems on which they follow the principle of physicalism to depend. In addition, the emerging core ideas show that consciousness or what we call the mind comes from and relies on complex biological systems. On one hand, consciousness may be a particularly interesting and complex level, including the whole knowledge, cultural, artistic and religious human life, but consciousness is not just the level of emergence, in a sense it is another side of feature of a series of evolutionary process. On the other hand, consciousness is not unique; it is only “a certain level of emergence”, so that the theory of emergence is not a camouflage dualism.

## **2. The historical trace of the concept of emergence: the re-grasp of the connotation of emergence**

Ancient and modern thinkers have long been concerned about the phenomenon of emergence. Aristotle’s famous proposition of “the whole is greater than the sum of parts” is the most valuable legacy of the ancient plain concept of the whole. Here the “whole” is from the “part” in the emergence of “whole”, but also has a very different attributes with the “part”. In Aristotle’s theory, everything in the universe is a complex emergent process of material [Lennox, 2014]. Even the four fundamental elements, fire, air, water and earth. The four elements are not pure; they are truly a mixture of complexity. For example, fire has the properties of hot and dry, air has the properties of moist and hot, water has the properties of moist and cold, earth has the properties of dry and cold. Everything has a new quality witch emerging from the complex mixture of other materials and exerting in a holistic downward and casual way. At the same time, it also shows that everything’s generation is the changing process from potential to reality. Therefore, Aristotle considers "Entelecheia" as the first mover of the entire world. And clearly pointed out that “Entelecheia” not only is the ultimate goal of all beings, but also reflects its own sufficiency. This actually shows the intrinsic purpose of existence of all beings. All the beings in the universe can find its own nature in its existence, and the process of the entire world is nothing more than the process that its nature and potential are gradually revealing and realizing. So we can say Aristotle’s cosmology is a concentrated manifestation of integrality and teleology, which is totally different from the cosmology of modern dualism. Aristotle wants to claim an organic, dynamic and holistic cosmology, which is based on the principles of “the form – material” and the four causes (which is led by final cause). In Aristotle’s theory, the entire world is dynamic, and everything is in the process of changing and dynamic emergence.

The ancient philosopher of China has also put forward the idea of ‘The world was born in all things, was born in nothing.’ The world was born in nothing' shows that ‘being’ is emerged through the ‘not-being’ [Meng, 2010]. Emergence began in the late 19th century, and formed in the early 20th century, it tried to use a new paradigm to explain the complex phenomena of natural and social science and the complexity of attributes. It is generally accepted that George Henry Lewes, by the influence of Aristotle, first proposed the term of “emergence” and gave philosophical

connotations of "emergence" in the "Problem of life and mind" that was published in 1875. In this book, "although each product is 'synthetic', we cannot trace every step of the reaction to find the type of activity of each actor. In the latter case, I suggest that the product should be called 'emergence'. It is a synthetic action, but does not show the activity of each actor ... each of the 'synthetic' is the sum of the forces, or the difference of forces ... they are clearly traceable ... and the 'Emergence' ... cannot be reduced to any kind of" [Lewes, 1874]. S.C. Pepper published the article of "Emergence" in the "Journal of Philosophy" in 1926, in the article, the emergence and related content were discussed in detail, and deeply studied the "emergence". Conway Lloyd Morgan, who as one of the most influential scholar of emergence in Britain in the 1920s, reconstructed the four main principles of philosophy of emergence: firstly, he did not accept Darwin's continuity principle; secondly, Morgan believed that Darwin's "natural selection" is not enough to make a full account of all the phenomena in nature, so he wanted to leave the philosophy of biology, and try to found a completely full of life form through the emergence; thirdly, Morgan made a strong exposition of the concept of the level of reality; fourthly, Morgan explained the different levels in the object of emergence on the strong emergence.

Along with the trend of the emergence, the concept of emergence quickly attracted the attention of the philosophical community and become a popular concept of research. The most representative is the British philosopher Alfred North Whitehead, Whitehead's theory of process can best reflect the emerging properties of things. He believed that every actual entity in the world is a concrescence which is emerged through the process of senses. But philosophers only focused on the ontology in the theory of emergence, they only had discussions around the nature of entity, and did not have a deeper and clearer interpretation about the possibility of emerging phenomenon. Therefore, this trend of emergence has not lasted too long. Subsequently, the theory of emergence disappeared for decades in 1930s. During this period, some philosophers, such as Michael Polanyi, continually advocated the support of emergence. British Critics of emergence, like Stephen Pepper and Arthur Papp, argued that although the evolution of thought had novelty, does not mean that it had philosophical significance. Therefore, the theory of emergence cannot make a new contribution to philosophy. Until the 1990s, the theories of emergence once again become a hot topic in science and philosophy. This boom makes the concept of the emergence extensively penetrates into the philosophy of mind, the cognitive science and other fields, promoting the development of these disciplines [Fan, 2015].

In addition, people may find that idealists like Hegel, materialists like Marx and Engels, positivists like Comte, and so on, all have accepted the theory of emergence [Mandelbaum, 1971]. As an idealist, Hegel did not regard the natural or physical world, but rather the conceptual world as his starting point. In this case, nature emerges from the idea. Feuerbach "reversed" the direction of Hegel, but he still stayed at Hegel's level. Marx carried out a more complete inversion through dialectical contradictions. Comte and his followers (especially Durkheim), insisting that high-level human ideas appear in the simpler predecessor, they thought this would help us to understand human society with the theory of emergence. But

science is crowned in the present age and becomes a legitimate successor of religion and philosophy. Therefore, people no longer follow the concept of the field or Plato's mode, but act in accordance with the basic principles of physical.

So what exactly is 'emergence'? People often want to find a simple definition of the emergence, but this is not so simple. Because in the ordinary language, this term is generally is not used as a technical term. The Oxford General Dictionary made 13 definitions of 'emerge / emergence / emergent', and the closest explanation of the technical connotation of emerging theoretical terms is 'produced by a combination of a series of reasons, but cannot be treated as the sum of the individual influences.' The last fifteen definitions of Webster's third new international dictionary emphasize that new factors appear in the evolutionary process or involve something new [Clayton, 2004]. If we have to give a definition in a word, then it can be said that the emergence is a repetitive theory of the evolution of the universe, it appears in an unpredictable, irreducible and novel way. But such simple definition is clearly inadequate: because they either superfine the union of multiple theoretical features, or silently sends a special view of no evidence to others. If you do not stop firstly to clarify the concept of emergence, then the further discussion would not be able to advance.

In general, we can understand a theory by understanding its opposite theory. Generally, the two opponents of the emerging evolutionist's position are: the position of the physicalism, which claims that the interpretation must be based on the components of some physical systems; and the dualistic standpoint, which promotes the causal effects of things, such as the essence of soul and spirit can never come from the basic physical attributes. Tim Crane depicts the two basic needs of the "dependency" and "uniqueness" as the emerging evolutionist positions: "the spiritual attribute is the property of the material object", but the "spiritual attribute different from the material properties". The presence of those independent relationships seems to be difficult to deny: destruction of enough intracellular molecules, one will no longer have cells; kill enough cells in an organ, the organ will stop working; observe your partner, if he takes into enough alcohol, then the conversation in its statement will not be so fluent.

Emerging means that the world shows a novel and irreversible cyclical mode. In the process of advocating this double declaration, the theorists of emergence walk out a narrow path between the two cliffs of physicalism and dualism. In fact, if the high-order attributes can be restored to the basis of the micro-physical phenomenon, then there are no doubt that (non-emerging) physicalism is correct. But the property of life or soul is different from the physical attributes, and it is not sufficient to explain the phenomenon of mind through the physical principles, and the soul is also difficult to understand in a dualistic way. But it could not express too much explains only by simply list "this is not or that is not", in this way we also could easily put the emergence into empty dualism, we should know the concept of emergence need to express a positive theme. But criticism continues, and some people point out that the novelty and irreducibility of emergence do not jump out of dualism, and it may still be a negative paradigm. The best words is saying that the phenomenon of evolution is

not as good as what happened before, but it is only not yet restored to it, and is not the same as the rule that they belong entirely to another reality.

Therefore, we must make a more convincing concrete description when we define the emergence:

- (1) the physicalism of the ontology: all the existence in time and space, are made up by the basic particles in the physical sense and their polymer;
- (2) the property of emergence: when the body's complexity of the polymer of the material particles comes to an appropriate level, then the real novel characteristics would emerged out from the complex system;
- (3) the non-reducibility of emergence: the property of emergence, which emerges from the low-level phenomenon, has irreducible and unpredictable nature. That is to say, these emerging properties will not be reverted to low-level phenomena, and these emerging attributes cannot be predicted from low-level phenomena;
- (4) downward causality: the emerging high-level entities usually causally affect the low-level components.

But it is clear that it is difficult to depict the entire contours through our brief description, which requires us to be further supplemented and refined: firstly, if the theory of emergence is correct, then it is bound to weaken the basic principles of physicalism. Physicalism has always believed that the entities in the real world are made up of various material materials. Although the form of a "material (or thing)" clearly requires the explanation of physics, the ontology of physics does not seem to be sufficient for this task, because the concept of physics is difficult to explain all forms of material. In contrast, the theory of emergence against the views which regard all the objects only as a physical aggregation, and firmly stand on the anti-dualist position. The emerging scholars argue that we should not assume that the entity is regulated by the existence physics. Therefore, the emergence, whether monistic or pluralism, is absolutely impossible to be physicalism.

Secondly, the novelty is actually a major attribute of emergence, but this attribute is only a latent attribute. Tim O'Connor describes the emerging properties in detail. He argues that the emerging attribute P in the object O is constrained by four conditions. (1) P replaces some of the attributes in O; (2) P does not contain any part of O; (3) P is different from any parts of O; (4) P directly (down) decisively influence O's partial behavior pattern [O'Connor, 1994]. From O'Connor's description of emergence, it can be seen: the emergence of the property is only hidden in some complex objects, and emerges under appropriate conditions, rather than as the elements of the object, always exist in any object among them. That is, the property of emergence is different from any structural attribute of the object. It is of great importance to definite the attribute of emergence as a latent attribute, this is a good answer about how the mind transcends physical behavior, in this way, avoiding the challenge of how the body and mind interact with each other.

Thirdly, the non-reducibility of emergence means that the property of emergence is impossible to restore to low-level phenomenon. Classical physics believes that complexity lies behind the simplicity and beauty, complex phenomena can be reduced to simple nature [Sun, 2013]. In the logic of mathematics, it is possible to

restore, because the laws and principles of mathematics are in a self-evident system at the beginning. The internal system is the ideal closed state, the internal structure is only a few simple elements, without the need for external information to exchange with the environment. This is quite different from the situation in nature; by contrast, nature is in a very complex system. In a complex system, it almost covers all the complex structure and movement state. Therefore, the use of logic in a simple system to explain the complex system is just like going to a dead end. Logical positivism has tried to use quantum mechanics to explain everything; the results can only be ended in failure. The fundamental reason is that physicalism sees the world too simple [Zeng, 1996]. The complex system in nature has numerous levels of emergence, “body and mind” is only one of the levels. Yale University biologist Harold Morowitz once pointed out that from the Big Bang to the present, there were at least thirty different levels of emergence in natural history. Therefore, the logic of reversion can be difficult to understand the movement and spiritual problems in a complex system.

Fourthly, the downward causality is the most important feature of emergence, and it is distinct from the microscopic determinism. It advocates the causal effect that a whole has the decision to parts. The effect of an emerging causal relationship occurs in the activity of the micro-attribute, which affects the macro attribute of the low-level thing in a “downward” way. But it is worth noting that the impact of this causal relationship cannot be reduced. The downward causality of the emerging structure represents a standardized causal relationship which is different from modern science. The concept of downward causality is the core argument of the theory of emergence, it well explains how the mind which is emerged from physiological structure, to conversely control and affect the physiological activities of human beings.

### **3. The core features and theoretical demands of emergence: from emergence to transcendence**

Having a definition of the emergence and its historical context will help us to realise a better analysis and understanding of the concept of emergence, and in this way, we can more accurately describe the outline and core features of emergence. Firstly, complexity incorporates a hierarchical mode. There is a special relationship between the emergence and the hierarchy. Emergencism argues that the world seems to be a hierarchical structure: more complex units are made up of simple parts, and they can in turn become “parts” to form more complex entities. As the product of emergence, hierarchy appears in a variety of emerging cases in the history of nature, for any two hierarchies, such as C1 and C2, C2 is emerged from C1:

(1) C1 has a priority status in the history of nature. (2) C2 depends on C1, and if some cases do not exist in C1, then this quality will not exist in C2. (3) C2 is the result of sufficient complexity in C1. In many cases, people can even determine a specific critical line, when it arrives at the critical line; the system will show a new property of emergence. (4) People sometimes can predict some new emergence or find new quality according to the knowledge of C1. But only have the knowledge of

C1, people could not predict the exact nature of these qualities, the rules that govern them (or their phenomenological patterns), and the processes that they are involved to raise the level of emergency. (5) The “reduction” which is in the standard of any scientific philosophy, is not a reduction of C2 to C1: it includes causal, interpretive, metaphysical or ontological reduction.

The tendency of emergence is a downward causality, and it is a causal influence and domination to the underlying organizational structure which comes from the upper’s whole structure. In general, the phenomenon of C2 use causality to have effects on the C1, but this is not restoring the causal history of C1. The non-reducibility of this causality is not only epistemological, but also in some sense is ontological: in the systems which are produced by the world, the emerging attributes use their own different causal influences to interact in a lower level. It is worth noting that the properties of emergence are new features of the object. For example, when the sodium atoms and chlorine atoms form together and become salt, the new properties which do not exist in the original atoms, would appear in the composite sodium chlorite [Charles, Birch & John B. Cobb, Jr, 2015, p.88]. But we could not simply say that C2 comes from C1, because it is tantamount to falling into the evolutionary theory which from simple to complex.

Secondly, the diversity of positions. Despite the fact that since the Enlightenment, the connotation of “materialism” has become increasingly limited. But when we want to build a natural world without foundation, some people still believe that the concept of material is not entirely negative, we should still accept such a premise – that is, everyone is a materialist. According to the current debate about emergence, on the one hand the emergence is posited in the stand of physicalism of non-reduction, on the other hand they believe that the downward causality still need dualism as its logical end, which is in fact a wrong understanding of emergence. The downward causality is not a dualism which is different from the Cartesian style, but rather means that this position is “pluralistic”. The downward causality as long as it is really present in the various levels of the natural world, and makes it possible for the object to make an ontological understanding at all levels, rather than merely treats existence as a polymer which is present as a low-level elementary particle (Ontological atomism), then the pluralistic position of emergence is solid. The so-called "dualism" position is only a special phenomenon in the special emergence level, rather than universally applicable to all levels in complex systems. (It is mentioned that Morowitz believes there are at least thirty different levels of emergency in the history of nature).

Thirdly, the transcendence of theory. The Newtonian system made great achievements of modern science because of its successful interpretation to the movement of objects, and also formed an academic trend in seventeen century. This trend held that everything in nature could be explained by atoms and their movements. Descartes once said, ‘give me matter and motion and I will construct the world.’ But when Descartes’ mode of mechanistic interpretation comes into the life of organism, we would find that it is hard to have a perfect interpretation of human’s mind. Once the internal structure of the machine has been determined, its external

behavior is also determined. But human beings have organic body, which is very different from cold machine, and it is also very difficult to explain the existence of life and mind by physical or chemical methods. This shows that the use of a purely physical way to study the natural world is problematic, so the suspension of the previous problem is that the interpretation of human behavior must be extended to the scope of physical science or not? Could the human activities which depend on the spirit seek an answer from the outside category of physics?

In contrast, the prerequisite for the emergence is supposing that the upward and downward effects are feasible, and the causality of emergence represents the most viable response to physical and mental problems. The brain is a complex interrelated system and has some very peculiar attributes – namely physical, biological, psychological and spiritual attributes. Although this high-level attribute emerges from the low level, they cannot be restored from each other, because these aspects are effective as different levels of emergence, and they are only different levels in the “system”. The human’s spirit (like free will, justice and other concepts) would be emerged through the physical (or biological) activity in the organic body, which is the embodiment of the complexity of organic body’s life phenomenon. While the explanation scope of reductive physicalism and dualism is very limited, and they may never be able to fully understand the processes and details of these novelty activities. Especially when they try to explain the emergence of the mind through an evolutionary process, this limitation will be particularly prominent.

### **Conclusion**

Science is more powerful than any other factor in changing our self-awareness and treatment of the world. The amazing achievements of science and technology make people naturally think that the field of scientific knowledge is infinite, and nothing is outside the scope of science. Some people are deeply embraced by the world reformism, while others argue that it has lost human nature and thus oppose all aspects of science. There is an intermediate line between the two, which is not only an answer to the success or failure of science, but also a prediction of the future [Clayton, 2004, p.205]. The emergence not only totally rejected physical science, it just find out that the nature world is much more complex and harder to grasp than physicalism. The discussion way about emergence before is just an ascending way, although this is not the only path, it shows that why it is wrong to equal the knowledge to the natural science. The emergence shows many questions that the physical science could not answer: what is the source of the Big Bang? If the existence of multiverse is possible, why an only principle can exist all the areas? In a world, when we follow the line from emergence to transcendence, could we find the answer of the question that we concern about? Our discussion does not means that physics and biology come to the end of the path, but means that they transcend their limit through the discussion.

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