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Suggesting the Scientific World views based on the History of Scientific Thought

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Abstract

Determinism, which is rooted in the metaphysical belief that objective scientific knowledge exists independently of humankind's perception, is comparable to a well-defined mechanism and can be described as "mathematization" as exemplified in the natural laws of dynamics established by Newton, Einstein, and Schrödinger. Conversely, if we break away from determinism, we need anthropomorphic concepts such as "possibility" and "contingency." This study aims to investigate the shift from the modern deterministic thought to the contingently perceived probabilistic theory of statistical mechanics, changes in scientific theories from a naturalistic point of view, and the convergence achieved through this process. Since the Darwin announced his theory of evolution, natural sciences have steadily undergone shift from endeavoring to name, classify, and measure to emphasizing the transience of things, historical interest, and theorization. The assertion that material forms were created historically rather than given and that their differences were not created according to supernatural images, but appeared naturally, starting from small mutations, was put forward to inculcate the fact that there cannot exist an accumulation of perfect knowledge of the world that had been considered possible thus far.Once the arrow of time is set, we can understand both unity and diversity, the two key features of nature. Unity arises from the common application of the arrow of time across the universe, and highly organized diversity emerges due to irreversible process of passing from one equilibrium state to another.

Keywords: Determinism, Dialectics, Darwinian evolution, Arrow of time, Identity, Difference

1. Introduction

The contradiction between a time-reversible position in physics and time-bound philosophy leads to an invariable collision. Should it be impossible to embrace a fundamental part of the human experience, interest in science would be meaningless. Heidegger's antiscientific stance is well known. Nietzsche also asserted that there are only interpretations without facts. Postmodernism as philosophy also posed a challenge to the Western rationalist tradition of truth, objectivity, and realism. Furthermore, the role of evolution in explaining nature has become increasingly important because it provides probabilistic and irreversible explanations. Weinberg argued that evolutionary patterns should be included in the laws of physics (Prigogine, 1996). Since Darwin introduced his theory of evolution in his book *On the Origin of Species* published in 1859, the concept of biological evolution has been at the center of debate for over 150 years, developing into a scientific theory through numerous verification processes not only in the field of life science, but also in all areas of the natural sciences. The position occupied by the evolutionary concepts in biology is becoming increasingly central and important, as appropriatly put by Dobzhansky: "The concept of evolution is the core principle that integrates all the concepts of life science with an integrative principle that can understand all living things on Earth, including humans, their relationships, and the world surrounding them." (Dobzhansky, 1973, AAAS, 1989, Sober, 1993).

This phenomenon is attributable to the radically reduced proportion of experiments, which used to be the decisive research tool of modern science, and the increasing emphasis on the dimensions of activities, highly complex domains, and individual circumstances. We have no means to experimentally explore the Big Bang, evolutionary processes, and complex-system theories. Disciplines in the natural sciences now ensure their quality not through verifiable truth, but rather through the acceptance of a sort of aesthetic form. Nature has long been showing no new truth to researchers. They are now led to make aesthetic interpretations of nature and pursue idealistic projection of the human mind.

Science is the last stage in the development of the human mind and can be regarded as the achievement most characteristic of human culture. It is the peak and culmination of all that humanity has achieved to date, the final chapter of human history, and the most important subject matter of the philosophical study of man.

Science starts from simplicity. However, logical simplicity is a goal, not a starting point. All disciplines of the natural sciences must pass through a mythical stage. In scientific thought, alchemy precedes chemistry, and astrology astronomy. Science could move beyond these initial stages by introducing a new measure of truth, namely, a logical measure. This study aims to explore the current positions of scientific worldviews by tracking their changes over time. To this end, three research questions were formulated:

RQ1. What is the metaphysical framework for establishing a scientific worldview?

RQ2. What are the roles of dynamics and statistical mechanics that justify a scientific worldview in exploring the flow of a scientific worldview in their historical context?

This paper explores the changes in scientific worldviews from these two perspectives in a historical context. Figure 1 illustrates the scientific and philosophical viewpoints covered in this study and related theories along with their development pathways.

2. What is the metaphysical framework for establishing a scientific worldview? What are the roles of dynamics and statistical mechanics that justify a scientific worldview in exploring the flow of a scientific worldview in their historical context?

Y-axis (Ontology):

Metaphysical realism (knowledge is fixed) and dialectical thinking (knowledge changes)

Metaphysical realism is the view (belief or claim) that there is knowledge of truth that is an objective fact (reality) independent of the human mind; that is, scientific theories express a single truth or reality.

For Parmenides, founder of the pre-Socratic Eleatic school, change is only an illusion, and only what exists in the present is real. Parmenides is understood as a philosopher who discovered the world of reversibility, i.e., the "immutable" world unaffected by the lapse of time (Mainzer, 1995, p.20). Plato's idea strongly reflects the immutable world. According to metaphysical thinking, phenomena are divided into fixed and immutable opposites, such as good and evil, love and hate, life and death, truth and falsehood.

In contrast, the position claiming that ontological (realistic) fact does not exist as knowledge or as objective knowledge is called anti-realism or dialectical view. That is, scientific theories are simply well-operating models.

Dialectical thinking acknowledges not only the coexistence of opposites pairs, but also their unity, mutual penetration, interaction, and reciprocal changes. In the 5th century BC, Heraclitus published the principles of opposing tension (Baghavan, 1987. p.75). Dialectics can be said to be the principle of the unity of opposites. Heraclitus declared that the principle that governs the universe is opposition, arguing that everything is propped up by a balance of forces and a battlefield of opposing forces (Baghavan,1987. p.130). Heraclitus is credited for discovering irreversibility, i.e., the arrow of time. On this note, he argued that the Logos, the law of change, itself is immutable and eternal (Mainzer, 1995, p.20).

In stark contrast to the metaphysical standpoint, Darwin regarded change as being perfectly normal and as part of creation and its potential. For this difference in opinions, he breaks away from Plato's ideal world.

X-axis (epistemology): perspective of idealism (rationalism) and materialism (empiricism)

How can we justify and judge that knowledge that we believe to be a fact (reality) is true?

What is the primary criterion for verifying the truth of propositional knowledge derived from a metaphysical belief?

- Through reason: rationalism
- Through experience: empiricism
- Through natural utility: naturalism (pragmatism)

What is the status (position) of such knowledge?

- Rationalism (coherence: intelligent and plausible)
- Empiricism (empirical accuracy)
- Naturalism (utility)

For example, the problem of justification work becomes even more challenging when different theories are derived. The first answer to this question is that one should choose a theory that can better respond to empirical or observational rules. However, in some cases, two opposing theories may not be judged superior or inferior by the available amount of evidence. This can happen when, for example, if two theories can explain the same set of facts. In this situation, Carnap recognizes simplicity as a secondary selection criterion. Carnap distinguishes between two types of simplicity. One of them, Euclidean geometry is more complex, but greatly simplifies the system of laws of physics. Thus, Einstein and his followers prioritized systematic simplicity over computational simplicity (Carnap, 1995, pp.162-64). The status of knowledge rises if a basis for better evidence for theory selection can be provided. Research programs that show a tendency to shift from theoretical to observational terms or programs in which descriptive benefits increase over time should be preferentially selected. (Hess, 1997, p.73).

What value was applied to justify and judge the statement claimed to be true?

- Cognitive value: empirical accuracy, simplicity of theory, internal consistency or coherence of theory, etc.
- Noncognitive (social) value: sociocultural values, social utility, etc.

What approach was used to access the statement claimed to be true?

- Philosophical approach: logic, dialectic
- Scientific approach: dynamics or statistical dynamics

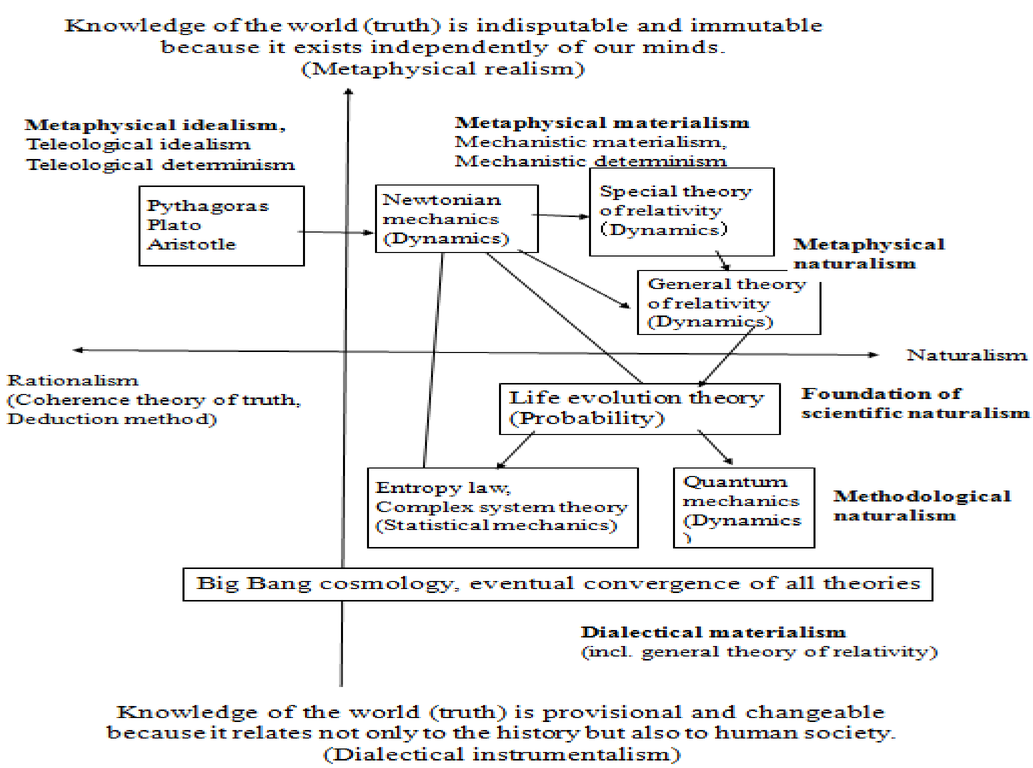

Figure 1. Constellation of the scientific worldviews from a scientific and philosophical points of view

From Plato to Descartes, perceptions were viewed as inaccurate and prone to errors. This fallibility of perception made rational thinking a preferred approach to justifying beliefs about facts to empirical observation. On the other hand, the empiricist Bacon emphasized systems of knowledge could be built based on iterative measurements. Both approaches separate subject and object, with the firmer (rationalist) designed to induce the rational subject to access the objective object, and the latter (empiricist) intended to use the objective object as a trap, that is, as a law and theory of nature (Davis, 2004, p.130).

First, in philosophy, sources of knowledge are categorized into idealism and materialism. Idealism views matter as the product of rational ideas, and materialism views ideas as the product of matter. The interpretation of the dialectic, to which we attach great importance, as the content of natural sciences strongly implies that dialectic is more likely to combine with materialism than idealism, but this is not necessarily the case. This is because the content of natural science itself can be interpreted with either materialism or idealism.

Among the subdisciplines of physics of the 20th century, quantum mechanics established the wave-particle duality of light as a scientific fact that no one has been able to refute to date. Light has the properties of both waves and particles, with particles tending to occupy certain positions and waves to disperse, which are termed locality and nonlocality, respectively. Thus, light embraces two opposing properties. Idealistic and materialistic philosophical interpretations were given to this scientific fact that puzzled physicists in the early 20th century. The particle nature of light was hypothesized to explain the special experimental results known as the photoelectric effect in the late 19th century, and the wave nature to explain the traditionally known results of interference and diffraction experiments. Therefore, from the perspective of idealism, the particle and wave properties of light are not objective properties of light, but subjective properties that appear depending on the choice of the experimental object by the researcher. From the perspective of materialism, although the light appears only when the subject performs the experiment, it is shown through the objectivity latently in its duality.

Second, a dialectic approach opposes strong determinism, advocates weak determinism, and suggests another important feature. This third dialectic feature regards the cause of any global change as a contradiction. According to weak determinism, global changes are determined by the interaction between inevitability and contingency. The ultimate dialectic answer to the question about why the world changes is “because there are contradictions in the world.” Evolution occurs by the interaction of heredity and mutation, which are characterized by opposite properties. Heredity has the inevitable property that the same trait passes on to the next generation, while mutation has the contingent property that enables the expression of new traits that are better-adapted to the environment. Evolution would be impossible if only one of heredity and mutation were to be 100% dominant. In this respect, evolutionary theory is dialectical. A dialectic approach is a worldview with a well-knit structure combining non-reductionism and weak determinism.

Materialistic and dialectic materialism and naturalism

Regarding the changes in the world, including society and ideas, as well as nature, there are also two views: mechanistic, and dialectic views. The former asserts that the phenomenon changes, but not the essence, and the latter holds the view that both phenomena and essence change.

First, the mechanistic view put forward reductionism, and the dialectic view non-reductionism. Considering the subject matters covered by various discipline of natural sciences, the whole world can be represented by the following models in a multi-layered hierarchical structure in an ascending order from micro to macro scale: elementary particles, atoms, molecules, macromolecules, cells, tissues, organs, plants and animals when sorted by biological hierarchy and individuals, societies, ecosystems, earth, solar system, galaxies, and the universe by spatial hierarchy. These subject matters are applicable to to physics, chemistry, biology, physiology, psychology, social sciences, ecology, earth sciences, and space sciences. In this hierarchical structure, each upper layer is the sum of all the units of its immediately lower layer. This structure is termed "ontological hierarchical structure" in philosophy.

Reductionism is the position that in an ontological hierarchical structure, any phenomenon observed in the upper layer can be explained in principle, by laws and theories regarding the phenomenon of the immediate lower layer or the downmost layer. In other words, reductionism is the position according to which, if the basic material particles and the basic science that deals with them are determined, the subject matters of other sciences can all be explained by the laws and theories of the basic science. Physics is usually set as this basic science.

However, according to non-reductionism, it is impossible to fully explain the phenomena of an upper layer in the ontological hierarchy with the laws and theories of the layer immediately below it or at the bottom. This is because when the sum of the units of the lower layer forms those of the upper layer, the essence absent in the units of the lower layer appears in the units of the upper layer. Therefore, in order for reductionism to be established as a viable principle, the cultural and social nature of human beings must be fully explained by the attributes of dogs or horses or of genes. Non-reductionists also use the method of reduction, but acknowledge its limitations.

Second, the mechanistic and dialectic views have recourse to strong and weak determinism, respectively. Strong determinism is a philosophical principle according to which there is no contingency in the world, but everything is decided by inevitability. According to weak determinism, things are determined by the interaction of contingency and inevitability.

Strong determinism, which relies on inevitability rather than contingency, includes Newtonian mechanics and Einstein's cosmology, whereby Einstein admits that a new science gives rise to a new quality. On this note, Einstein's cosmology may also be assumed to have dialectical properties. Consequently, this study classifies the special theory of relativity to be closer to Newtonian reductionist mechanics pertaining to reductionism, and the general theory of relativity to be farther away from Newtonian mechanics. That latter particularly stands out with its aesthetic sense emphasizing the coherence between the constituent theories. Einstein's cosmology is thus characterized concurrently by the properties of strong causal determinism and dialectical creativity.

According to weak determinism, things in the world are governed by both inevitability and contingency. Due to contingency, even if we know exactly the present state of things, there is no certainty about the future state, but only probabilistically. In the world of weak determinism, in which all events of the world happen by the interaction of inevitability and contingency, nothing is definitively determined. This stochastic weak determinism is applicable to quantum theory and evolutionary theory. Therefore, I classified quantum theory and evolutionary theory as dialectical materialism. However, given that the reversibility of time is commonly applicable to all phenomena, it also reflects Platonism characterized by immutability and eternity.

C lassical science analyzed the world in different parts and developed the Cartesian method by arranging these parts according to the law of causality. The resulting deterministic view of the universe was closely associated with the cosmic image like the clock-work. In atomic physics, however, such a mechanistic and deterministic view of the universe is no longer applicable. According to quantum theory, the world cannot be analyzed as an isolated element with an independent existence. The concept of isolated parts (atoms and subatomic particles) is only an idealization with approximate validity. Nor are these parts connected by causality in the classical sense. Since the behavior of any part is determined by a nonlocal connection to the whole, which is unknown to us, the narrow classical concept of causality needs to be replaced with the broad concept of statistical causality. The laws of atomic physics are statistical laws, which govern the dynamics of the entire system to determine the probability of atomic events. In classical physics, the properties and actions of parts determine those of the whole. In quantum theory, the situation is reversed, where it is the whole that determines the actions of parts (Capra, 1982, p.110).

This nonlocal concept combined with the concept of statistical causality clearly suggests that the structure of matter is not mechanical. As early as 1951, David Bohm argued that the flow of knowledge is directed towards a nonmechanical reality and that the universe was more like a “Great Thought” than a “Great Machine.” (Caplan, 1978). The clear similarity between the structure of matter and the structure of the mind is that human consciousness plays a decisive role in the observation process, and also determines the properties of observed phenomena in atomic physics to a great extent. The consciousness of the human observer always lies at the end of this process. If I ask a particle question, I will be given a particle answer, and if I ask a wave question, I will be given a wave answer.

The two theories of modern physics (quantum and relativity) transcended the fundamental aspects of Cartesian dualism and Newtonian physics. Quantum theory states that subatomic particles are not independent grains of matter, but models of probability and interconnectedness in an inseparable cosmic web, which contain human observers and their consciousness. The theory of relativity has shown that this cosmic web is inherently dynamic and that this activity represents an ontological essence (Capra, 1982,p.117).

Quantum mechanics can predict the future by analyzing the passage of time based on a probability distribution. As a result, whereas the detailed location and momentum are indeterminate, the wavefunction changes over time allows to identify the patterns of time-dependent changes, thus enabling to establish causal relationships between past and future events and actions, albeit not as strong as Newtonian mechanics and the theory of relativity. The advent of quantum mechanics based on the uncertainty principle resulted in the stranding of the determinism that arose from Newtonian mechanic. Unfortunately, however, many people including philosophers misunderstood the stranded determinism as the end of the causal theory. In other words, with the advent of quantum theory, determinism and causality were misunderstood. It was simply said that determinism was broken because nothing was determined, which was misunderstood as meaning that because the cause is unknown, the conclusion cannot be unknown. The truth is that determinism is broken and nothing is determined, but causality holds, albeit weak.

Boltzmann did not regard theories and scientific concepts as reflections of the objective world. Nor did he think it was fixed or immutable. To the contrary, our representations have constantly changed under the influence of new experimental facts, gradually approaching the full reflection of reality. He reflected on the problem of the interrelationship between emotional and the rational aspects of cognition, the problem of the role of hypothesis, and the problem of the significance of mathematics in the study of physics from a materialist point of view. Boltzmann's materialism was very limited and leaning towards mechanistic understanding. This limitation is a de facto denial of infinite development of matter in qualitatively diverse motion forms in his fluctuation theory (Russian Academy of Sciences, 1988, p.321).

Evolution that takes place in biological systems has a certain temporal direction because it is inevitably an irreversible process. Just as the irreversibility of evolution is a statistical consideration, so too is the second law of thermodynamics based on a statistical consideration. As a matter of fact, it stands to reason to view the irreversibility of evolution as the expression of the second law of thermodynamics in biological systems. With the second law of thermodynamics pertaining to a statistical prediction, a macroscopic system often comes to reverses the direction of entropy for a short period of time. Such exceptional movements are captured by the replication mechanism of living beings, and preserved by natural selection. Clearly, evolution is a sort of time machine that goes back in time, along with contingent factors and natural selection. However, the Earth receives enormous amount of solar energy every day. This energy gives the Earth system as much energy as to partially override the second law of thermodynamics. This suggests that the second law of thermodynamics is applied well in the domains including the sun, where nuclear change occurs continuously.

In order for a hypothesis to become a theory, it should involve the latest findings of quantum theory. The right to life does not include many predictable objects or events. Rather, there will be certain types of objects and events, and their overall attributes and interrelationships will be predicted. However, prediction cannot be made regarding specific individual objects or events will never exist and their properties. Living beings are not of a kind that can be predicted by the first principle, i.e., ab initio quantum chemistry, as mentioned in quantum theory. If a being can be deduced by the first principle, then it must exist as its prerequisite. In other words, it has a duty to exist (*devoir d'exister*). On the other hand, if this being cannot be deduced by the first principle, but is compatible only with probability, that is, if it is not impossible to exist according to these principles, then it obtains the right to exist (*droit d'exister*)(Monod,1970, p 54). In other words, it is made clear that evolutionary theory is a probability theory, not a determinism based on weak causality, as is the case with quantum mechanics. From this trait of generation and change coupled with contingency (*hasard*), not inevitability (*nėcessitė*), it can be inferred that evolutionary theory share the optimistic nature of materialism, which always emphasizes evolution. However, it is not invariably necessary to know the object itself. Dialectical materialists also attacked the pessimistic law of entropy.

This study places the theory of evolution at the beginning of all modern science on the grounds that it accepts the optimism of dialectical materialism, change and generation on the time axis, explanations of quantum mechanics and weak causality, and the strengths of living beings. Darwin's theory had a revolutionary impact on scientific research already over a century ago.

The assertion that material forms were created historically rather than given and that their differences were not created according to supernatural images, but appeared naturally, starting from small mutations, was put forward to inculcate the fact that there cannot exist an accumulation of perfect knowledge of the world that had been considered possible thus far. In the post-Darwin era, research direction in the natural sciences has shifted from labeling, classifying, and measuring to emphasizing transient things, historical interest, and theorization (Davis, 2009, p.114).

If the world were made up of static and stable dynamics, the world would be very different from what we see now. Such a static world would be predictable, but the problem is that it would be a world where humans would not exist to conduct the measurements. In the world as we know it, there are fluctuations and instabilities at all levels. A static system in which certainty exists pertains only to idealization and approximation.

Once the arrow of time is set, we can understand both unity and diversity, the two key features of nature. Unity arises from the common application of the arrow of time across the universe, and highly organized diversity emerges due to irreversible process of passing from one equilibrium state to another (Prigogine, 1996).

Since the 19th century, people have become increasingly interested in time. Hegel, Husserl, Bergeson, Heidegger, and Whitehead are eminent examples among the philosophers who took special interest in time. For physicists like Einstein, the problem of time as solved. For philosophers, however, time still remains a central epistemological problem underlying the meaning of human existence.

Here are two widely-quoted statements on time. Popper: Physical theory, which is seemingly deterministic, and Laplace's determinism, which appears to be the success of the theory, have serious difficulties in explaining human freedom, creativity, and responsibility (Popper, 1963, Preface, Ref.1). Bergeson: Isn't time a vehicle that carries creativity and choice? Does not the existence of time prove that nature is indeterministic? (Bergeson, 1959, p.1331). Determinism corresponds to a well-defined mechanism and can be considered "mathematization," as seen in the laws of nature established by Newton, Schrödinger, and Einstein. In contrast, moving away from determinism, it becomes necessary to adopt anthropomorphic concepts such as "possibility" and "contingency".

Metaphysical naturalism, often referred to as "philosophical naturalism" or "ontological naturalism," adopts an ontological approach to naturalism. Ontology is a subdiscipline of metaphysics that studies existence and holds the view that there is nothing supernatural. So, it has entailed strong atheism. It instructs to develop from a nonempirical to empirical reality using a sort of "fundamental emergentist" process. Modern physics, i.e., the theory of relativity and quantum mechanics, took their start from nonempirical reality through mathematical abstraction, and have been developing towards empirical reality. This is a physicalist naturalism defending determinism. In evolutionary epistemology, scientific knowledge evolves through with random mutation and mechanism of selection, giving up essentialism in living beings and to attaching importance to emergentist view.

In stark contrast to metaphysical naturalism, methodological naturalism states that science is neither metaphysical nor favorable to the ultimate truth touted by metaphysics for its success (although science has metaphysical implications). However, metaphysical naturalism must embrace a strategic and operative hypothetical character in order to attain success as a science. Einstein who advocated realism may be considered a metaphysical naturalist. In contrast, quantum mechanics, which attaches greater importance to scientific methodology than to realism debate, can be classified as methodological naturalism.

3. Conclusions and Proposals

Quantum mechanics cannot have independent properties when the observed is separated from its observer. That is, the physical properties of the observed are revealed only in interaction with its observer. According to Newtonian mechanics, however, the physical properties of the observed are shown independently of the observer. his claim can be described as a metaphysical belief that constructs the basic framework of a worldview. On what grounds can this belief be justified?

As materialism with emphasis on empiricism, classical mechanics is categorized into dynamics and statistical mechanics to approach scientific theory

From the dynamic viewpoint of determinism:

First, because dynamics is inherently time-symmetric, it is a causal determinism to be determined as one for the future.

Second, the theory of relativity and quantum mechanics are also time-symmetric like Newtonian mechanics. However, quantum mechanics shows probabilistic determinism in association with observation.

Third, Einstein's theory of relativity has an aesthetic beauty that is an inner characteristic of scientific theory. It provides a logical simplicity of the premise of the absolute speed of light, symmetry and unity of the integration of the two theories, the inevitability of spacetime continuum, and the like.

From a relativistic perspective, even if time increases or length contracts, the world does not change. When a moving observer observes himself, neither is his lifespan lengthened nor is the space reduced. It only appears that way to other observers. It was postulated from the beginning that the special theory of relativity should be applied equally to all observers because this world is real and can become a world of immutable reality.

From the statistical mechanics of probability theory:

First, the theory of evolution is positioned as dialectical materialism according to which truth is generated, changed, coexists and interacts with the opposites, moving away from the metaphysical thinking of Newtonian mechanics that truth is fixed and polarized into fixed and immutable opposites.

It was believed that God created the universe in an extremely harmonious way, properly using mathematical proportions. Newton and Einstein regarded this Platonic thinking as an immutable truth, not an irreversible assumption. In contrast, Darwin's theory insisted on the idea that truth is generated and changed.

Second, it concerns the evolutionary arrow of time irreversibly moving from the past to the future, anchored in modern scientific worldviews such as entropy law and chaos theory. It is also characterized by nonteleological weak causality. Considering group behavior means that the sheer amount of data makes statistical dynamics the only option. That is, it appears as a probability theory due to ignorance.

Third, conversely, quantum mechanics can predict the existence probabilistically using wavelike overlapping before observation. Once observation begins, the sites of contraction or wave function collapse are revealed in a state of verification, which is an inherent characteristic of nature, not ignorance. In my view, quantum mechanics also views spacetime as a plane like Newton. Consequently, in the world of very small atoms within the framework of Newtonian mechanics, quantity of discontinuous energy rather than a continuous quantity, so everything cannot be judged with a definite determinism, and given that influences between theories are nonlocal, but are transmitted integrally, it is inherent in nature to make probabilistic judgement instead of ignorance in the form of statistical mechanics ignorance. According to Bohr, there is an inseparable relationship between a measuring instrument and the measured—that's where probability comes in—and the quantum system is changed irreversibly.

From a convergence perspective

Lastly, it is obvious that what we call comprehensible and scientific discovery was in the past favorable conditions for survival. However, it is not clear whether this still holds true. A completely unified theory may not be of much help to our survival. For example, the partial theory of Newtonian mechanics may be more practical than the unified theory of relativity.

However, since the beginning of civilization, people have not been satisfied with events that are isolated and inexplicable. People longed to understand the fundamental order of the world. Our aspiration for such knowledge is sufficient to justify our continued search for one integrated and unified theory.

In general, new scientific theories are proposed to resolve the conflict between existing theories and observed facts. However, in the history of science, Einstein had a problem with the symmetry between the existing theories, and the fusion between theories was undertaken in order to solve the symmetry. The special theory of relativity is a fusion of theories in the direction of resolving the conflict between the electromagnetic law and classical mechanics, and the general theory of relativity between inertia and gravity.

Revolutionary new theories of 20th-century physics (relativity, quantum mechanics, Big Bang) derived a variety of radical ideas. The aesthetic perception of symmetry connected with fusion has gained a firm foothold in the world, and the idea that the world is a constant change and creation rather than a machine has been passed into our culture. First and foremost, there are nondeterministic elements in the microscopic world. The bottom line: a probabilistic world, rather than strict determinism, is being established in our culture.

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