

Enlightenment of the Combinatorial Notion

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Abstract: As is known to all, the science's function lies in guiding human activities and promotes the human civilization. However, science is the knowledge of humans ourselves on things in the universe. While it benefits humans, the accumulation of humans intrusion on the nature is increased year by year, causes the reaction of nature on humans such as the global warming, ice caps melt, sea level rise, extreme weather, drought, earthquakes, tsunamis and other natural disasters in the eyes of humans and affects human activities to some extent also. This fact awakes up humans to look at science with its leading to human activities and reflects the nature of science again. Among them, a most important question is *whether science is absolutely true or only local and conditional true?* Different answers to this question determine the attitude towards science with its application, namely living in harmony with or govern the nature. In fact, one's recognition on things is carried out by the "six sense organs", namely, the eyes, ears, nose, tongue, body and mind of human, which have certain limitations by their working mechanism. Accordingly, science is only a local recognition or conditional true of things. In this case, how to form a combined recognition based on their inherited topological structure of things and then to hold on the reality of things by local recognition is an important work in the development of science. In fact, this is nothing else but the combinatorial notion on recognition of things in the universe, explained detail in my book *Combinatorial Theory on the Universe* (in Chinese).

Key Words: Local recognition, cognitive limitation, scientific limitation, Smarandache multispace, mathematical combinatorics, combinatorial reality, harmonious coexistence of humans with the nature.

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§1. Introduction

Essentially, the science lies in the recognition, holds on things in the universe and so as to promote human's living ability and benefit to humans ourselves.

Recently, I have finished the book *Combinatorial Theory on the Universe*. It systematically presents a combinatorial notion on scientific recognition, i.e., the combinatorial conjecture

¹Reported at the book launch of *Combinatorial Theory on the Universe* (in Chinese), September 27, 2022, Beijing, P.R.China.

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for mathematical sciences of mine proposed in 2006 to guide the recognition of things in the universe, which asserts that *any mathematical science can be reconstructed from or made by combinatorialization*[4-5], first reported by me at the *2nd Conference on Combinatorics and Graph Theory of China*, Tianjing, August 16-19, 2006. In fact, this conjecture is a kind of philosophical thought that reconstructs and develops science furthermore, and greatly promotes the human recognition of things in the universe ([9]).

The book *Combinatorial Theory on the Universe* (in Chinese)[16] including scientific recognition, mathematical sciences and philosophy was published by the Chinese Branch Xiquan House, USA in August, 2022 and distributed globally by the Global Knowledge – Publishing House. After publication of the book, the *First Construction Media of China* organized a book launch of *Combinatorial Theory on the Universe* (in Chinese) to recommend this book and spread my philosophical thoughts in Beijing on September 27, 2022. A group photo of this launch is shown in Figure 1. It is a little surprising that the participants of this launch reached more than 22,000 online and most guests gave a high evaluation on this book.



Figure 1

In this book launch, Mr.Qingzhong Ping, a professor of the *Academy of Internet Industry of Tsinghua University* evaluated this book as a universal instruction, comparable to *Critique of Pure Reason* of Kant, which aims to reveal the truth of human recognition and it has established the mathematical foundation for the digital economy, meta-universe to a certain extent; Mr.Dezhong Wang, the president of *Zhong Guan Cun Public Resources Optimal Allocation Association* evaluated this book as a “Universal Book” and said it is a yellow book that can accompany one’s lifelong learning, has profound effect at first reading, interesting effect once again and insight effect at close reading. Many scholars in this launch claim that this book will have a place in the academic history of humans, which motivates me to write this paper for further spreading the academic notion that I explained in the book of *Combinatorial Theory on the Universe* (in Chinese).

§2. Science: Local or Conditional Reality

Certainly, science leads human activities and its function is to promote the material and spiritual civilization of humans, improve humans ability for surviving and benefit humans ourselves. In this way, believing in science and acting according to scientific laws is a basic principle of

human's conduct. But *how many humans can understand this principle correctly?* The answer is unclear because most humans are standing on the humans side, understand this principle simply just for human benefits and ignore the intrusion of human activities on the nature. This is a narrow understanding of science because in the binary system consisting of humans and nature, the effect of nature on humans is immediate, visible by humans at once. However, the reaction of nature on humans caused by human's action on the nature is a delayed effect. It will appear only if the disturbance of nature caused by human activities accumulated to a certain amount, which will forms a disaster reaction on humans, i.e., produces the effect “*from quantitative change to qualitative change*” such as those destruction of the ozone layer, temperature rise, ice caps melt, extreme weather, drought and virus mutation, etc., also harmful to human development. It should be noted that this cumulative effects alone may not be visible to contemporary ones. Whence, one can not standing only on the humans side in response to scientific functions, can not only see the benefits of science to humans in present and allow the intrusion on the naturae without limitation. They should put the science with its application in the harmonious coexistence of humans with the nature and discuss its contribution and the harm to humans because science's benefits to humans should first guarantee the sustainability of human reproduction, i.e., not only the benefits to the present generation but also to the benefits of future generations. This ruler should be the basis or scientific motivation for the continuation of human civilization.



Figure 2

We should answer a basic question for recognition before exploring the science's function, i.e., *whether science is absolutely true or only local and conditional true?* The answer lies in a famous fable, i.e., the blind men with an elephant. In this fable, *why did the blind men respectively perceived the shape of an elephant as a pillar, a rope, a radish, a big fan, a wall or a pipe such as those shown in Figure 2?* Their answers are so different from the shape of an elephant in the eyes of an ordinary man. Why do they so answer is because of the blind men lack of vision. They can only perceive the shape of an elephant by touching parts of the elephant's body with their hands and different parts of an elephant are bound to be different perception. Indeed, the blind men touch different parts of the elephant's body for perceiving the shape of an elephant. Similarly, science is the human recognition of things in the universe, which is similar to the situation of the blind men in this fable. It is human's local recognition of unknown things with known characteristics. Consequently, the scientific recognition is not the real face of things but a local or conditional knowing of things. This

recognitive limitation comes from the limitation of “*six sense organs*”, i.e., the eyes, ears, nose, tongue, body and mind of human in perceiving things [2-3]. Compared with an ordinary man, a blind man is lack of vision, only with five or less sense organs in the perception of things. This is the reason why it results in the different recognition of blind men on an elephant shape. So, how to solve the recognitive limitations of humans is an important question. The answer is what the sophist said to the blind men in the fable, namely, “*You are all right about the elephant! The reason why you think the elephant’s shape different is because each of you touches the different part of the elephant’s body. In fact, an elephant has those all characteristics that you are talking about!*” Notice that the sophist uses the “*six sense organs*” of human to arouse the recognition of the blind men only with five or less sense organs on the shape of an elephant, which is also applicable to the perception of things by the “*six sense organs*” of human. That is, the reality of a thing T should be the combination of all local recognitions on T , i.e, the *combinatorial reality* and we should hold on the reality of things in the universe by the combinatorial notion. Certainly, the combinatorial notion on the reality of things is really a philosophical thought that humans follow the guidance of the sophist in the fable of the blind men with an elephant to solve the recognitive limitations of humans and then hold on the reality of things. A further generalization of this recognitive way that the sophist told the blind men is called the *Smarandache multispace* or *multisystem* ([6-7, 17-18]). For example, the unified field theory, gauge field theory, electroweak theory and the standard model of particles are all Smarandache multisystems. Furthermore, a combinatorial model for the recognition of a thing T can be established on its Smarandache multispace or multisystem by considering the intersection of spaces or systems to form a combinatorial structure, a combinatorial notion also. For instance, the twelve meridians on which the vital energy and blood are moving is such an example of combinatorial model for recognizing the body of human in the traditional Chinese medicine, which are correspondent to the viscera organs of human body.

Usually, one needs to find the “*cause*” of a thing for its appearance “*effect*” and holds on the causal relationship of things. Among them, a systemic way is to decompose a thing by its appearance into the smallest units called *elements*, including the molecules, atoms, nuclei, leptons and quarks in material composition as well as the cells and genes in biological composition. Then, a behavior of the thing is assumed can be understood by its element behaviors, and the “*effect*” of its appearance is traced by the “*cause*” of the elements. This is the recognitive thought of reductionism. However, *is it possible to hold on anything in this way?* Certainly, it is an ideal model for systematically understand the causality of a thing. The difficulty lies in how to determine the elements from its appearance of things and characterize the action of elements. In this process, *how to determine the elements and how to characterize the behavior or the action of elements?* Such questions may become also the obstacle for holding on the truth of things. It is for this reason that our science is still a local knowledge of things rather than the reality of things. In this case, science with its applications needs to be evaluated under the harmonious coexistence of humans with the nature once again, to verify whether it is promoting human civilization rather than harming humans or excessive intrusion into the nature which will affects humans finally.

Realized this point, taking the quantitative recognition of things as the main line constraint

on the ruler of harmonious coexistence of humans with the nature and using the combinatorial notion as the recognitive thought of things, it is a meaningful thing to systematically review and reflect on mathematical science and philosophy for the recognition of humans. In fact, I have been most concerned about the relationship between mathematical science and the recognition of things in the past ten years. Most of the topics that I reported in some academic conferences are related to the word *reality* (see [8-15] for details) because I think it is the most important that science needs to solve and it is necessary coming back to the philosophical thought of the combinatorial notion on the reality of things. Generally, a thing inherits a topological structure in space. We should establish an envelope mathematics, i.e., the “*mathematical combinatorics*” ([8-9]) for solving the limitations of scientific recognition and gradually tend to the reality of things. This is the initial intention that I wrote the book *Combinatorial Theory on the Universe* (in Chinese). For this objective, I choose the contents and arrange the order of chapters. In its expression, I apply the dialogue of a father with his daughter in sections, also with some vivid images to help the reader understand easily this book. In fact, if one removing the mathematical formulas and deduction, this book can be used as a popular scientific book. Notice that the contents containing mathematical formulas with deduction, including the last two chapters on the philosophy of science in this book is to guide those who are interested in mathematical combinatorics and aim to help them further study on the literatures for related topics and then, we can realize the harmonious coexistence of humans with the nature.

§3. What is the Book of Combinatorial Theory on the Universe About

There are 12 chapters in the book of *Combinatorial Theory on the Universe* (in Chinese), arranged in order [16]. Some main contents of each chapter are mentioned in the following.

Chapter 1 – Chapter 2 are an introduction to scientific recognition. Among them, Chapter 1 “*Ultimate Questions on the Universe*” presents the ultimate questions of the universe in the voice of a schoolboy, namely *where do we come from and where we will go?* including the celestial bodies, the earth, plants and animals and aims to briefly introduce scientific hypotheses or answers to such questions for children. Usually, a scientific answer often do not satisfy students in primary school because they do not believe in authority and like to repeatedly ask “*why*” for their frank desire of knowledge, which often leads to the disappearance of an adult’s answer. But this frank attitude to study is exactly the quality of one engaged in scientific research. This chapter also introduces the answers to such ultimate problems in religion and legends in Chinese culture. It is not to propagate the superstition but in comparison because the answers in religious or the cultural legends are more vivid than scientific explanations and more accessible to primary school students. This is the object that the school education should pays attention to. Chapter 2 “*Perceptible Limitation on the Universe*” explains the limitation of human recognition of things, including the origin of human evolution and the legend of religion or god creation. Certainly, the “six sense organs” of human impact on the recognition. And in recognition, how to understand that “being out of non-being” and how to construct phenomenological theories by recognition of things such as grain cultivation and livestock rearing in the early period of humans are introduced. As an example, this chapter

takes the double-slit experiment of physics in Figure 3 to summarize the limitations of human recognition, including the structural limitations of human eyes, ears, nose, tongue, body and mind which form three cases of perceptible unknown, unknowable and conditional limitation of humans. This chapter also introduces a few legends such as the Nuwa creation, Shennong taste herbs, the story of Adam and Eve ate forbidden fruits, the phenomenological theories such as the traditional Chinese medicine, the Kepler three laws of planets, etc.

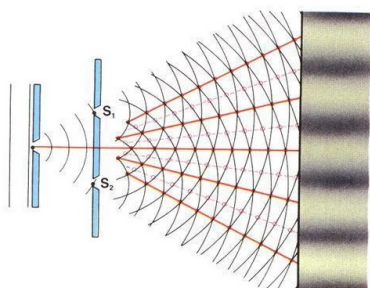


Figure 3

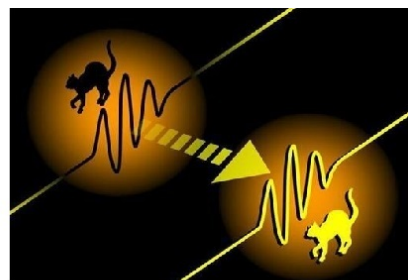
Chapter 3 “*Combinatorial Notion on the Universe*” explains the combinatorial notion of systematic recognition of things on local recognitions and verifies the combinatorial notion by summarizing the methods of recognition in physics, chemistry and biology as examples. It begins with the famous fable of the blind men with an elephant as an introduction with graphs, labeled graphs and topological graphs in space and then, shows the reductionism establishes local sciences such as it had done in physics, chemistry or biology but we can establish an envelope science by the combinatorial notion, i.e., the science over inherited topological structures of things. For counting elements in a Smarandache multispace or multisystem, this chapter introduces the *inclusion-exclusion principle* and *pigeonhole principle*, also introduces a generalization of the pigeonhole principle, i.e., the existence of substructure with certain relationships among individuals if the number of individuals large enough, which affirmatively answers the Ramsey problem in combinatorics. Certainly, the combinatorial notion of things derives easily the “technological combination” [1] in theory. However, we can get this conclusion by simulating the decomposition of matter. In fact, the social development is reflected by the improvement of human’s ability adapting to the nature such as those of the improvement and innovation of artificial appliances, devices and facilities. Among them, a technology is a kind of methods, techniques and means to make such appliances, devices or facilities possible. Similar to the structure of matter, a technology can be viewed as a combination of blocks which have their own combinatorial structure and the block is a combination of sub-blocks with a specific function, is the next level of technology. Similarly, the function sub-block is also a combination of next level sub-blocks of functions, which is the next level technology. In this way, the decomposition of a technology level by level will eventually reaches to the elementary components in the technical composition, likewise the elementary particles. Indeed, different technologies are all combination of the elementary components of “*function*” or “*effect*”.

Chapter 4 – Chapter 6 are the basis of systematic recognition of things by reductionism. Among them, Chapter 4 “*Characterizing the Universe*” introduces the characterizing methods

of things in a reference frame, including the reference frame to determine the position of a thing with change characterizing, Einstein's relativity principle, vector algebra, linear space with basis, Newton mechanics, n -body problem, and the application of Newton's law of universal gravitation in determining the first, second and third velocity of universe, Lorenz transform in Einstein's special relativity theory, etc., points out that the essence of Einstein's principle of general relativity is the mathematical display of the philosophical thought that objective things are not transferred by human's will. Chapter 5 "*Systemic Recognizing the Universe*" is designed to the combinatorial notion of systemic recognition and methods of things, including the system structure, combinatorial characteristics of system and the motifs in the systemic recognizing of things. This chapter introduces physical dimension and the measuring methods of distance objects and micro particles, involved such as the quality, time, system, also the state equation of a system, the solution and the solving methods, etc. Particularly, the stability of system and the Lyapunov's direct judgment, linear and hyperbolic nonlinear systems are discussed. And corresponding to the recognitive thought of combinatorial notion of things, a philosophical thought on mathematics is introduced also. That is the combinatorial conjecture for mathematics, i.e., *mathematical combinatorics* which extends mathematics over topological structures in space. Chapter 6 "*System Synchronization*" aims to introduce an interesting synchronization phenomenon in the nature and explain the method of determining, regulating of system synchronization. It is pointed out that up to now, humans benefited from all systems simulating animal behavior such as automobile, train, ship, aircraft and other mechanical movements are based on the system synchronization and regulation of system elements. To this end, this chapter presents the major methods for determining the system synchronization, including the master function method, graph criteria as well as the introduction of error term converts a synchronization problem into the stability of system and the control of the system synchronization, explains the 2-matrix norm and Lyapunov index often used for determining system stability, system synchronization, etc.



(a)



(b)

Figure 4

Chapter 7 "*Contradictory Systems*" applies the combinatorial notion of things to explain and characterize contradictory phenomena of things in the eyes of human, which is extremely different from the textbook. It should be noted that the contradiction is caused by one's recognition, implied in the definition or named process of Laozi explained in his *Tao Te Ching*, i.e., replaces the reality of things by local recognitions, not the real face of things because he said that "*the heaven and the earth view all things as straw dogs*" [2], i.e., all things are fair in

the universe and the recognitive principle with “*logic consistency*” should be followed in this case. In this point, the allegory of Hanfeizi’s contradiction of ancient China in Figure 4(a) is essentially consistent with the living-death state or quantum collapse of the Schrodinger’s cat in Figure 4(b). The problem lies in how to describe the living-death state or contradiction of Schrodinger’s cat. For resolving the contradiction, the parallel space or 2-branch tree was introduced by H.Everett to explain the living-death of Schrodinger’s cat covering both the living and the death states of the cat, which is in fact a special case of Smarandache contradictory systems, Smarandache multispaces or multisystems. To this end, this chapter explains the Smarandache contradictory systems, Smarandache geometries, Smarandache multispace or multisystem and the relationship of Smarandache denied axiom with them [15]. On this basis, the application of Schrodinger cat’s living-death state or quantum entanglement, quantum teleportation and the disentangling Smarandache multispaces and multisystems in the field of communication are discussed. Notice that the expression of Laozi’s “*Name named not the eternal Name*” [2] in the symbol deduction of mathematics is the limitation of mathematics, including the limitations of mathematical abstracting and deduction, which usually appears as a non-harmonious group or system of non-solvable equations, i.e., a system is unsolvable with contradictions but its each equation is solvable. It is worth noting that different from the equations in classical mathematics, the combined solution of a non-harmonious group always exists, which provides the condition for characterizing such groups, including the sum stability and the product stability of non-harmonious groups.

Chapter 8 “*Complex Networks*” introduces the by-product in studying social phenomena, i.e., complex network which characterizes the social behavior of humans with certain randomness. Of course, a human’s behavior is not completely random because he or she has a brain. So, it is only an assumption that human social behavior can be characterized by randomness. This chapter introduces some common random distribution, the law of large numbers, the central limit theorem and the network indexes. On this basis, the complete stochastic model introduced by Eröds and Rényi in the 1960s, the related network index and properties are introduced in details. In this field, the WS small-world network represents a breakthrough in the use of randomness to simulate social behavior, whose randomness is between the regular networks and the completely random models. At the same time, the BA scale-free network describes the connection of new sites with existing sites on the internet, corresponds to the phenomenon of “*the richer is more and more rich, the poorer is more and more poor*” in a society leading by the capitals. An extension of the BA scale-free network is the local world network. Different from the simple construction of differential equations to describe the spread of disease, the real spread of disease is carried out on the social network, which is related to one’s social circle. Based on this situation, this chapter introduces also the application of various complex networks to simulate community networks, analyzes the SI, SIS, SIR models and describes the law of the spread of diseases on the social network.

Chapter 9 – Chapter 10 apply the combinatorial notion of things to generalize network flow to continuity flow, regard it as a new mathematical element for mathematics, which can be used as the mathematical model of things under the combinatorial notion. Among them, Chapter 9 “*Network Arithmetic*” begins with an introduction on some optimal problems in network and

the methods operation on graphs, analyzes the possibility of simulating the behavior of things by network and constructs the operation system on network under the condition that the combinatorial structure of the network is unchanged. At this time, the network operations is similar to the operation of vectors, only need to keep the structure remains the same its in evolution, on which the metric can be introduced similar to that of the linear space and applying both the discrete or continuous model for simulating thing behaviors, namely the network sequences and the continuous networks, construct the algebraic operation, differential and integral operation on networks. In this way, the Newton-Leibniz theorem of integral operation on networks is generalized as an example. Chapter 10 “*Combinatorial Reality*” introduces the mathematical model that simulates the evolution of things under the guidance of the combinatorial notion of things, namely continuity flow. Certainly, the continuity flow is a generalization of network. That is, the labels of network vertices and edges are no longer limited to real numbers but vectors in Banach space. At the same time, operators in Banach space can be introduced on edge flows with requiring them to obey the law of flow conservation on vertices. This chapter begins with an introduction to Banach space, Hilbert space and some important results as well as three hypotheses of quantum behavior in quantum mechanics. Similar to network, continuity flow can also be regarded as a kind of mathematical element on which the operations such as the addition, subtraction, number multiplication and the Hadamard product can be defined, and the Banach space and Hilbert space on continuity flow, i.e., Banach or Hilbert flow space can be constructed and applied to the stability of continuity flow also. For describing the dynamic behavior of continuity flows, the Lagrange equation of continuity flows is obtained by the principle of least action. It should be noted that some important conclusions in functional analysis can be generalized on Banach flow spaces by using G -isomorphism operators. Particularly, the theorem of Fréchet and Riesz representation on Banach flow space holds which implies that the assumption of quantum behavior in quantum mechanics holds also. That is, whether a quantum has intrinsic structure or not it will not affects the conclusion of quantum mechanics.



Figure 5

Chapter 11 – Chapter 12 belong to the philosophy of science and discuss how science can promote human civilization in the combinatorial notion of things. Among them, Chapter 11 “*Chinese Recognizing the Universe*” aims to take Chinese civilization as an example to explain how the ancient Chinese perceived things and how the Chinese civilization formed under the

thought of “one union of the heaven and humans”. That is, the principle of the harmonious coexistence of humans with the nature. This chapter also compares some scientific achievements of the Chinese with the western. Particularly, Laozi’s explaining on the creation of the universe, the relationship between the heaven, the earth and humans in his *Tao Te Ching* is compared with the theory of big bang. It points out that the western science is a local recognition of the law of things, i.e, “*Tao*” while the ancient Chinese were a recognition on the whole life cycle of things and behaviors. At the same time, this chapter introduces two typical examples for applications of continuity flows. One is the surprised theory of the 12 meridians and the relationship with the viscera organs of human body established on the Yin-Yang theory by the ancient Chinese such as the Hand Yang Ming large intestine meridian (LI), Foot Shao Yin kidney meridian(KI) and the Foot Shao Yang gallbladder meridian (GB) shown in Figure 5. Another is the corresponding of the 64 hexagrams in the *Change Book* to the continuous flow over cycles of order 6 such as those shown in Figure 6, which is essentially the soul of Chinese science and a scientific method for understanding objective things rather than a superstition.

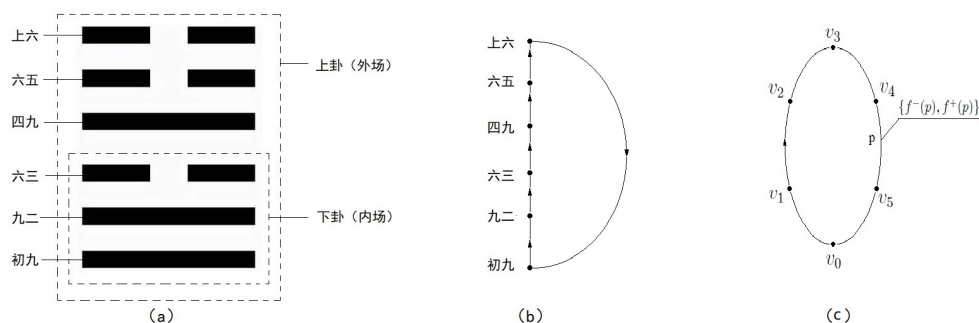


Figure 6

Chapter 12 “*Philosophy of Science*” aims to reaffirm that science is a kind of local recognition or conditional reality of things and to discuss how science promotes human civilization under the harmonious coexistence of humans with the nature. This chapter takes the *Theory of Everything* as an example, outlines the application of Smarandache multispace or multisystem in the development of science by combinatorial notion and points out also that humans should take the initiative to limit or end some fields or directions in science development. That is, science needs to have a limiting scale or standard while recognizing things in the universe for conducting the behaviour of humans and promotes humans harmonious coexistence with the nature, including those that affects the order of universe, destroys the biological diversity or affects the behavior of humans ourselves so as to realize the human activities guiding by science do not disturb the nature, which is the fundamental principle of human development.

§4. A Most Important Objective of Science

A central issues of philosophy of science is to discuss the ultimate goal of science or how science should develops. Certainly, science serves the ultimate goal of humans. So, *what is the ultimate goal of humans, to dominate the earth or the universe?* Of course Not! In the times substance

shortage, the leader leads all humans of the clan to compete for resources or war with other clans or groups for the survival and continuation of the clan. In the times of organized production and material prosperity, humans are more greedy for spiritual enjoyment. Whence, the ultimate goal of humans is to satisfy the material needs first and then, to realize the spiritual needs of humans. At the same time, there are no a individual or population in the universe can dominates the earth or the universe, and the humans are no exception also. In this way, the ultimate goal of science in the service to humans is to promote the progress of human civilization and living in harmony with the nature. Since science is the local recognition of things by the “*six sense organs*” of human, its improper application in the benefit of humans is surely bound to disturb the nature because its effects will inevitably come back to humans after accumulated to a certain extent, resulting in a dilemma of science. However, the initiative to get out of this dilemma is in the hands of humans ourselves. That is, science should study how not to disturb the nature and realize the harmonious coexistence of humans with the nature while it benefits humans. This is the biggest challenge that science faces in guiding human activities.

Personally, I believe that the harmonious coexistence of humans with the nature is the most important objective in the development of science with the promotion of human civilization in the 21st century ([11-12]). In this process, the initiative to realize the harmonious coexistence of humans with the nature lies in humans ourselves. For this objective, the first is necessary to reflect on the immoral behavior in the past that humans excessively intrude on the nature, the second is to study the scientific programme of harmonious coexistence with the nature, to correct and eliminate the harm caused by human’s excessive intrusion on the nature in the past and the third is the review and restraint of humans ourselves, including the immoral behavior in previous human activities and consciously harmonious coexistence with the nature for everyone. In this way and only in this way, the ultimate goal of our humans will comes true.

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