LIU Gang

Philosophy of information and foundation for the future Chinese philosophy of science and technology

Abstract The research programme of the philosophy of information (PI) proposed in 2002 made it an independent area or discipline in philosophical research. The scientific concept of ‘information’ is formally accepted in philosophical inquiry. Hence a new and tool-driven philosophical discipline of PI with its interdisciplinary nature has been established. Philosophy of information is an ‘orientative’ rather than ‘cognitive’ philosophy. When PI is under consideration in the history of Western philosophy, it can be regarded as a shift of large tradition. There are three large traditions at large, known as Platonic, Kantian and Leibniz-Russellian. In the discussion of the position of the possible worlds, we have modal Platonism and modal realism, but both of the theories are made in the framework of Western philosophy. In this essay, it is argued that possible worlds could be seen as worlds in information, which is then an interpretation of modal information theory (MIT). Our interpretation is made on the basis of Leibniz’s lifelong connection with China, a fact often overlooked by the Western philosophers. Possible world theory was influenced by the Neo-Confucianism flourishing since the Song Dynasty of China, the foundation of which is Yijing. It could be argued that Leibniz’s possible world theory was formulated in respect to the impact of the thoughts reflected in Yijing, in that one of the prominent features is the model-theoretic construction of theories. There are two approaches to theory construction, i.e., axiom-theoretic and model-theoretic. The origin of the former is from ancient Greece and the latter from ancient China. And they determined the different features of theoretic structures between the oriental and occidental traditions of science and technology. The tendency of the future development of science and technology is changing from the axiom-theoretic to the model-theoretic orientation, at least the two approaches being complementary
each other. To some extent, this means the retrospective of tradition in the turning point of history, and some of the China’s cultural traditions might become the starting points in formulating the future Chinese philosophy of science and technology.

**Keywords** philosophy of information (PI), computational/information turn, foundation for future Chinese philosophy of science and technology, modal information theory (MIT), Leibniz and China, Neo-Confucianism, model-theoretic vs. axiom-theoretic

1 The birth of a new paradigm in philosophy

Philosophy of information is a new discipline of philosophical inquiry with the appearance of cyberspace and the coming of cyberage. This discipline deserved various titles recently, for example, cyberphilosophy (Bynum 2003, Liu 2004a) and philosophy of computing and information (PCI) (Floridi 2004a). However, I am much inclined to call the new philosophy ‘Philosophy of Information (PI) (Floridi 2002, Liu 2002a, 2002b, 2003a, Benthem and Adriaans 20041). A new paradigm in the philosophy emerged since the very beginning of this century (Adams 2003, Dodig-Crnkovic 2003, Floridi 2002, Liu 2002a, 2004b).

Philosophy of information, as a new theoretical field, gives special attention to the following two areas: a) the critical investigation of the conceptual nature and basic principles of information, including its dynamics, utilization and sciences, and b) the elaboration and application of information-theoretic and computational methodologies to philosophical problems (Floridi 2002, Liu 2002a, 2003a).

Information and computer science (ICS) and information and communication technology (ICT) have already shown their tremendous impacts on our society. Since the 1990s, the international community of philosophy made deep reflections in front of the great challenge of the information revolution, and put forward ‘computational turn’ (Burkholder 1992). It is commonly said that Leslie Burkholder coined the phrase ‘computational turn’ in 1992. Just as Robert Cavalier pointed out in his inaugural speech, ‘The last quarter of the twentieth century brought the beginnings of a Computational Turn in philosophy in regard to both teaching and research. It was, I believe, Leslie Burkholder who first used this term, comparing the richness of this event to the Linguistic Turn in philosophy. This turn is quite deep and its impact will no doubt broaden during the first decades of the 21st Century’. 2 In 1998 The Digital Phoenix, a collection of essays was published

---

based on a general survey of the US community of philosophy with an interesting subtitle “How computers are changing philosophy”, in which Terrell Ward Bynum and James Moor acknowledged that there emerged a new force in philosophy,

From time to time, major movements occur in philosophy. These movements begin with a few simple, but very fertile, ideas—ideas that provide philosophers with a new prism through which to view philosophical issues. Gradually, philosophical methods and problems are refined and understood in terms of these new notions. As novel and interesting philosophical results are obtained, the movement grows into an intellectual wave that travels throughout the discipline. A new philosophical paradigm emerges… (Bynum and Moor 1998, p. 1).

Methodologically, computer provides such a powerful tool for the philosophy and thus this philosophy is regarded as ‘tool-driven’ rather than the so-called ‘concept-driven’ as in the field of physics. Just as Freeman Dyson put it for he called Internet as one of the tools of scientific revolution (Dyson 1999). And Michael Heim said that the cyberspace formed by computer network is nothing but a metaphysical laboratory, a tool for examining our sense of reality. (Heim 1993, p. 83). Computing even goes beyond this just as Bynum and Moor go on,

Computing provides philosophy with such a set of simple, but incredibly fertile notions—new and evolving subject matters, methods, and models for philosophical inquiry. Computing brings new opportunities and challenges to traditional philosophical activities… Computing is changing the way philosophers understand foundational concepts in philosophy, such as mind, consciousness, experience, reasoning, knowledge, truth, ethics and creativity. This trend in philosophical inquiry that incorporates computing in terms of a subject matter, a method, or a model has been gaining momentum steadily (Ibid.).

In 2002 Luciano Floridi put forward ‘information turn’ (Floridi 2002) and Fred Adams even went further simply declaring that the ‘information turn’ of philosophy happened at “the midpoint of the twentieth century as the beginning of the informational turn” (Adams 2003). Later in 2004, Metaphilosophy issued another important essay by Floridi, which was a revised version of the speech delivered at The Herbert A. Simon Lecture on Computing and Philosophy given at Carnegie Mellon University in 2001 (Floridi 2004). Minds and Machines consecutively issued two special issues on PI in 2003 and 2004. Blackwell published the Guide to the Philosophy of Computing and Information in 2004, which is the first book in this field integrating the interests of computing and information in a single
volume. Elsevier is now snowed under with *Handbooks of the Philosophy of Science* of 14 volumes, among which volume 8 is entitled *Handbook on the Philosophy of Information*, edited by Johan van Benthem and Pieter Adriaans (Benthem and Adriaans 2004). In addition, various professional conferences have been held worldwide in recent years and American Philosophical Association (APA) Committee on Computing and Philosophy (CAP), a local academic organization supported the formation of the International Association of Computing and Philosophy (IACAP). The International Association of Computing and Philosophy is active in Europe, Asia-Pacific and North America areas by supporting international conferences such as E-CAP, AP-CAP and NA-CAP every year.

Information as a concept of ‘retroactive prefiguration’ in philosophy is that it is recognized as a fundamental notion not only in the natural sciences and technologies but also in the humanities and social sciences. It is especially essential in understanding physical computation, communication, and human cognition. There happened several ‘turns’ in the Western philosophy, e.g., from being to knowledge initiated by Kant and to meaning in the last century, now information comes into the range at the very beginning of the new century. Philosophy of information with its emphasis on the ‘information turn’ is taken as an orientative rather than a cognitive philosophy. Cognitive philosophy concerns much more with ‘what’, taking philosophy as an activity pursuing the establishment of knowledge and the corresponding systems. Orientative philosophy, on the other hand, inquires about ‘how’, i.e., it points out the orientation of our interests to a specific field or direction. Orientative philosophy is by all means higher than the cognitive philosophy both in its philosophical nature and profoundness. Therefore, special attention should be paid to the orientative philosophy in the new century (Liu 2004).

2 Paradigm shift in philosophy with the rise of philosophy of information

Any school should be rooted in its own context of thought from philosophical traditions. Without a tradition the school of this philosophy cannot be subsumed. As a result it cannot go any further. What is the context of thought for PI in the philosophical traditions? The shift based on the PI can be seen as a mirror of the shift from the industrial to the informational society. And from the perspective of the history of philosophy, such a shift can be regarded as a shift of a large philosophical tradition (Liu 2003b). Then what is it?

The opening sentence in IACAP’s history reads, “the convergence of computing and philosophy has a lineage going back to Leibniz, his ‘calculus’ and
his ‘adding machine’”3. It is obvious that Leibniz is regarded as a key figure in forming the new philosophy under discussion. In my opinion, Leibniz opened up a new type of inquiry in philosophy some three hundred years ago for his work on traditional logic.

Generally, there are two approaches to the history of philosophy—one is the normal approach according to the textbooks, and the other, to the philosophical traditions. G. MacDonald Ross wrote a textbook entitled Leibniz giving out the normal approach popular at present. In the very beginning of the Introduction of Leibniz he showed us the picture of the known scenario,

Traditionally, university courses on the history of modern philosophy have been structured round a pantheon of seven great philosophers: three ‘continental rationalists’: Descartes, Spinoza and Leibniz; three ‘British empiricists’: Locke, Berkeley and Hume; and Kant. The empiricists were supposed to have believed that all our knowledge was built up out of the data of sense, whereas the rationalists were supposed to have restricted genuine knowledge to what could be deduced from indubitable truths of reason. Kant, on the other hand, created a new synthesis out of what was right in both empiricism and rationalism. Needless to say, this way of viewing the history of philosophy was invented by Kant himself. It has, however, had a remarkably long run for its money. (Ross 1984, p. 1)

Kant had his own reason and purpose when he made the ‘new synthesis’ in his times. However, whenever the philosophy of Leibniz is concerned there are always particular difficulties to put into the Procrustean bed invented by Kant. The reason is to be explored in the next section.

How to release Leibniz into our present discourse of PI? I’ll try to explore another scheme following the philosophical tradition. Western philosophy can be categorized as Platonic, Kantian and Leibniz-Russellian traditions (Mu 1997, p. 27) or just classic, modern and formal traditions at large.4 Here the formal tradition, or more narrowly, the Russell-Couturat line (Mungello 2004) is concerned with which is known to the philosophers of the Anglo-American tradition due to the works of Bertrand Russell and Louis Couturat.

Norbert Wiener, the founder of cybernetics, viewed Leibniz as a patron for cybernetics, because his work is closely related with two concepts—universal language and logical calculus (Wiener 1948). Obviously, scientists viewed Leibniz’s contributions as ‘universal language’ and ‘logic calculus’. In effect, Leibniz only gave out an idea and some initial steps but he did not bring his ideas into reality. It was Russell that did the technical jobs at last. So we have sufficient reason to hook up Leibniz with Russell, i.e., from Leibniz’s logical algebra to Russell’s *Principia Mathematica*. Actually, Russell also takes Leibniz as a pioneer of mathematical logic. In his *History of Western Philosophy*, Russell gives out his evaluation on Leibniz on this account, saying that Leibniz was a pioneer of mathematical logic and saw its importance prior to anyone else. (Russell 1955, p. 620) And it has been generally acknowledged that why he became the father of the symbolic logic is due to the heuristic of the intelligible features of the Chinese characters. (Lewis 1918)

From the evaluations by Wiener and Russell, Leibniz is important only when he is technically considered and his philosophical theory was overlooked. Russell even thought his metaphysics was nothing but a vain hope. Russell is clear that almost all of the philosophy of Leibniz came from his logic. And his logic is simply considered to be some sort of subject-predicate logic, i.e., $P$ existing in $S$.

As a realist, Russell is a philosopher of single-world assumption or real world model, that is to say, any symbols and formulas in the formal system should be understood as objective, and all of these abstracts represent their real beings in the real world. After analysis, they are finally the habitats in our real world. This view of reality is clearly expressed in his *Introduction to Mathematical Philosophy*, in that he calls for sound sense of reality for logicians (Russell 1930, p. 159). To sum up, Leibniz was seen and interpreted by Russell via a single-world spectacle, so that it is partial or even misleading, even though Russell is considered to be an expert on Leibniz. It is ridiculous to see that Leibniz’s philosophy was split into good and bad ones in Russell’s works. In Russell’s opinion, his logic is good but secret and metaphysics derived from the logic is bad and vulgar and should be thrown away. I would rather argue that logic could not only be seen in a superficial and technical way just as Martin Heidegger pointed out (Heidegger 1978, Eng. tr. 1984). Logic does have a metaphysical foundation.

---

7 Alfred Whitehead was the co-author; therefore, Whitehead was as important as Russell, just as Michael Heim pointed out in his email to me. In effect, Whitehead’s *Process and Reality* could be seen as a modern version of Leibniz’s *Monadology*. As Leibniz’s philosophy was divided into good and bad by Russell, he took the good one, i.e., the mathematical logic and Whitehead took the bad one, i.e., the metaphysics. So far to my knowledge, this might be argued further from an oriental perspective.
Russell turned Leibniz’s symbolic logic into the ‘classic logic’. C. I. Lewis, however, was dissatisfied with the key notion of ‘material implication’ in Russell’s system. He thought it too far away from intuition and too weak for our common sense to understand the concept of implication. According to Lewis, it should be strengthened. Finally, he put forward ‘strict implication system’, in which two modal words—‘necessary’ and ‘possible’—were used, and on which the ‘strict implication’ calculus systems, $S_1$–$S_5$, were constructed, which means that he initiated the ‘modern modal logic’. Lewis not only improved Russell’s system with his construction of strict implication system, but also revived the theory of possible worlds of Leibniz. Saul Kripke put forward the ‘theory of possible worlds’ in modal logic semantics. It is often said that Kripke à la Leibniz, which means his semantics was created according to the ideas of Leibniz. It was Leibniz in the seventeenth century who employed the concept of ‘possible worlds’ for the first time when he was constructing his philosophical cosmology.

Now as in the Ideas of God there are an infinite number of possible worlds, and as only one of them can be actual, there must be a sufficient reason for the choice of God, which leads Him to decide upon one rather than another. (Leibniz 1898, p. 53)

The fundamental idea of Kripke’s semantics of possible worlds is to prescribe the various conditions of modal propositions in respect to the models constructed according to accessible relations on set of possible worlds. Hence, his semantics based on the work of Alfred Tarski is also called ‘relational semantics’. In effect, the semantics of possible worlds have already been widely accepted in the international community of logic, becoming a standard to check other kinds of semantics, i.e., other newly constructed semantics should be compatible with Kripke’s relational semantics. The semantics of possible worlds realized the idea of semantics of formal language proposed by Leibniz. With the ideas of semantics shifting from the model of the real world to that of the possible worlds, the focus on logical inquiry also shifts from syntax to semantics. In a recent essay, Floridi also pointed out that there are five concepts of information which are relevant with semantics. (Floridi 2004b)

The rise of PI means a series of transformations, e.g., from modern to formal tradition; from real world to possible worlds; from syntax to semantics (Floridi 2004b); from the theory of proofs to the theory of models; from geometry to algebra; from classic logic to modern logic, from pursuing diachronic identity to pursuing synchronic similarity; from the philosophy of science to the philosophy of information (Dodig-Crnkovic 2003); and so on and so forth. In terms of Western philosophy this change can be viewed as some sort of the ‘primacy
of forms’ to the ‘primacy of materials’ at large. However, the philosophical empiricists have long been in doubt with any philosophical analysis with contents for they don’t believe in such a thing as the primacy of materials. However, the issues discussed about those in favor of the primacy of materials are often related to in the fields in our previous metaphysics, ontology or ethics (Stegmüller 1986, p. 151).

3 Leibniz’s China connection

The formal tradition showed the splendor of Western achievements, and it is the brilliance of Western culture. From Leibniz to Russell there are active results, which are positive and constructive rather than negative and destructive. However, it should also be pointed out that the fatal deviation along the Russell-Couturat line is that it is too narrow to encompass Leibniz’s profoundness, and especially his lifelong link with China. It is rather interesting to see that the philosophy of Leibniz was divided into good and bad ones in Russell’s works. With his Anglo-Saxon speculation, he said that Leibniz “had a good philosophy which (after Arnauld’s criticisms) he kept to himself, and a bad philosophy which he published with a view to fame and money” (Russell 1955, p. 604). Actually, Russell failed to see the fact that in Leibniz’s philosophy there is “a concurrence where logic and metaphysics come together in fruitful symbiosis” (Rescher 1981, p. 56). In the next section I would discuss the symbiosis of Leibniz’s logic and metaphysics and show the embarrassment of the ontological position of information as well as a solution to the situation.

The fantastic aspect of Leibniz’s philosophy is that it combines with reason rather experience. Logic is only a rational tool to approach to his metaphysics of nature. Now let us have a brief survey of China’s impacts on Leibniz’s philosophy.

Leibniz is considered as an avid Sinophile, in his inquiry of a *characteristica universalis* on which to order all human knowledge, he was drawn to the Chinese *Yijing* (Swetz 2003) and other sources. Ernest E. Hughes, an Oxford Sinologist said in the preface of his translations of *Daxue* (Great Learning) and *Zhong Yong* (The Doctrine of Mean) of Confucian classics considering that Leibniz was influenced by the Neo-Confucianism (Hughes 1942, Preface). And the critical concept of ‘simple substance’ and ‘pre-established harmony’ in Leibniz’s philosophy are the consequences under the impact of Chinese thought. In 1686, he

---

6 ‘Primacy of forms’ and ‘primacy of materials’ are only an analogous saying for I don’t think Leibniz is Platonic. He is really an ‘alternative’ in the history of Western philosophy for he had a life long and deep involvement with Chinese thought when he worked out his metaphysics.
systematically wrote down his idea in *Discourse on Metaphysics* (1686) in French. Hughes’ conclusion is that 1686 was a critical year when Leibniz turned from his naïve atom to monad, and the last piece of his philosophical work is *Monadology*. It is interesting, say, to find out the frequency of his correspondence with Antoine Arnauld (1612–1694) from 1686 to 1690. Joseph Needham, a Cambridge scholar on the history of Chinese science and civilization, wrote a special section of *Zhu Xi, Leibniz and the Organic Philosophy* (Needham 1956, p. 496ff.), where he pointed out that the Chinese thoughts generalized in *lixue* (studies of reasons and principles, or just Neo-Confucianism as Derk Bodde rendered) contributes more to the European thoughts than they have been acknowledged. And the whole significance in philosophy has not been apprehended as yet.

David E. Mungello, an American expert on Leibniz and Confucianism, gave out a sound study, trying to make a challenge to the orthodox theory proposed by Hughes and Needham. In his establishing monograph *Leibniz and Confucianism: Search for Accord*, he showed that Leibniz’s influential organism found in Chinese thought was not original inspiration but corroboration for his previously and independently developed notions (Mungello 1977). However, he has to acknowledge that the corroboration itself can be seen as an influence (Mungello 2000, p. 49). In this essay, I would argue on the base of Mungello’s corroboration theory rather than the original inspiration proposed by Hughes and Needham, for I think a weak foundation is enough for our present scenario.

Leibniz’s connection with China can be explored in the following aspects.

**Extensive Reading.** The style of scholarship in the seventeenth century is rather different from today to emphasis on narrow specialization. And the scholars had to read and write extensively in different fields of inquiry. When he was 20 years of age, Leibniz read *De Re Litteraria Sinensium Commentarius* (*Commentary on the Chinese Literature*) by Gottlied Spizel (1639–1691), where it introduced the Chinese natural philosophy and gave a detailed account of the doctrine of *Yijing*. Athanasius Kircher (1601–1680), a prolific Jesuit scholar who published around 40 works, most notably in the fields of oriental studies, etc. His *China Monumentis Illustrata* (*Illustrated Mementos of China*) (1667) was an encyclopedia of China, which combined accurate cartography with mythical elements such as dragons. The Belgium Jesuit Philippe Couplet (1623–1693) published a book entitled *Confucius Sinarum Philosophus* (*Confucius as a Chinese Philosopher*) (1687). It can be identified from a letter (Leibniz an Landgraf Ernst von Hessen-Rheinfels) (Leibniz 1687) dated on December 19, 1687 that Leibniz read this book in the very year when it was published. In this letter Leibniz briefly reviewed this book.

**Novissima Sinica and Correspondence with J. Bouvet.** In a letter dated on December 14, 1697, Leibniz wrote, “Je farai donc mettre une affiche à ma porte avec ces mots: bureau d’adresse pour la Chine, afin que chacun sache, qu’on n’a
s’adresser à moy pour en apprendere des nouvelles” (Leibniz 1697). The meaning is that he was preparing a board on his office door as ‘The General Office on Chinese Affairs’ and anything concerning China could be handled in this office and then would be transferred to the missionaries. After he met Claudio Filippo Grimaldi (1638–1712) in Rome, a Portuguese Jesuit stayed in China for some 17 years. By April 1697, Leibniz had accumulated enough messages on China from Grimaldi and other sources to publish Novissima Sinica (Latest News from China) (Leibniz 1697, 2005). Leibniz was an avid letter writer seeking the news on current events associated with China, especially with Jesuit missionaries to China, among whom was Joachim Bouvet (1656–1730), one of the first French Jesuit missionary members to China. Correspondence proved as important as books in transmitting Chinese philosophy to Europeans. In the seventeenth century, correspondence served to communicate knowledge in the way that scholarly journals do today (Mungello 2003, p. 88). As a result, letters among scholars were often lengthy and were reproduced by secretaries for further circulation. The correspondence allowed writers to exchange ideas that were too controversial to obtain official approval needed for publication. The correspondence between Leibniz and Bouvet from 1697 to 1704 is one of the most striking transmissions of philosophic knowledge of that age.

These letters have been often cited widely by scholars and in the beginning of the 1920s the Japanese scholar Gorai Kinzo went to Hanover to copy all of the letters and saw the diagram Bouvet sent to Leibniz, i.e., the Xiantiantu (prior to heaven system) worked out by Shao Yong (1011–1077), a famous Chinese philosopher of Neo-Confucianism. In his doctoral thesis on the impact of Confucianism on the German political thoughts, some of their letters were used. Leibniz studied the diagram of Fuxi’s characters, and annotated his copy in red ink. Leibniz must have observed this diagram previously but did not notice its possible connection to binary numbers (Swetz 2003). He sent his binary arithmetic interpretation to Bouvet and it was Bouvet who pointed out the association. Bouvet was driven by the possibility of revealing an ‘Ancient Theology’. In their collaboration, they complemented and reinforced each other’s beliefs. Unfortunately, their faulty Sinology also deceived them. In effect, there is also another system called Houtiantu (later heaven system) initiated as early as the 11th century BC. Shao Yong made a revolution to the system and invented the Xiantiantu, which initiated a new school of the inquiry of Yiijing, i.e., the Shuli (mathematical doctrine) school in addition to the Xiangshu (sign-numerical) and Yili (doctrine-rational) schools happened to be there in the native land of China for

---

7 This book was translated into Chinese and published in China and a symposium was held in July, 2005, Beijing. It is said this is the only translation in addition to its Latin original.
Pioneer of Sinology. Enlightenment Europeans admired Chinese cultures, and cultural borrowings and assimilation were apparent in both directions, at least up to the end of the 1700s. There were three groups of people throughout Europe. First, the Jesuits studied and publicized China at the most serious and deepest level. Second, ‘proto-Sinologists’ with a less focused interest in China, studied many different aspects of Chinese cultures, and were also serious scholars. Andreas Müller of *Clavis Sinica* (*Key to the Chinese Language*) was a proto-Sinologist. And Leibniz is another good example of a proto-Sinologist. Thirdly, the popularizers took a shallow approach to the study of China and sought to find support for European political and intellectual movements.

Leibniz’s last and most substantive works on Chinese philosophy was the *Discours sur la théologie naturelle des Chinois* (*Discourse on the Natural Theology of the Chinese*), which was stimulated by a distorted interpretation of Chinese philosophy by another influential seventeenth-century philosopher Nicolas Malebranche (1638–1715). In 1707, Malebranche wrote a small book on the existence and nature of God (Malebranche 1708) based on inadequate sources. The main reason why Malebranche wrote this dialogue is that he perceived Spinozism in Chinese philosophy. Writing the dialogue gave him the chance for two folds—one is to combat these irreligious traces and the other is to distance his own philosophy from Sponozistic monism and to rebut critics like theologian Antoine Arnauld. Malebranche attacked the Chinese for recognizing only one substance, which consisted of matter that differed in degree ranging from gross to rarefied. Malebranche’s interpretation dealt with a particular school of Confucian philosophy developed by Zhu Xi (1130–1200), known as Neo-Confucianism. Leibniz’s *Discours* rebutted Malebranche’s interpretation of Neo-Confucianism and showed them to be the distortions of a philosophic Eurocentrism. In addition, Leibniz justified the Neo-Confucianism in a manner that made his *Discours* the knowledgeable explanation of Chinese philosophy by a seventeenth-century European philosopher (Mungello 2003).

Unfortunately, a century later after the publication of *Novissima Sinica*, Johann Gottlieb Buhle (1763–1821) depicted a different picture of China in his *Course of the History of Philosophy* (1796). He said that it is obvious that the Chinese had commercial exchanges with European countries... but in the aspects of culture and the employment of reason it seems that the Chinese did not make any progress as might be expected. On the contrary, they still stayed on a common level. He did not mention the failure in the Rites Controversy of the Jesuit. And the author pointed out that it is the monopoly of the government, secret police elsewhere and the binding of qualified and talented personnel onto the tradition as well as the indifference and suppression that hurt the capability and encouragement of these
people. The hope of Leibniz was absolutely corrupted. This may be one of the reasons for us to be back to Leibniz and have a re-start (Poser 2000, p. 12).

As we have seen that along the narrow line of interpretation, Leibniz’s lifelong connection with China is regarded as peripheral to his main philosophical concerns (Mungello 2004) so that it seems that the Anglo-American philosophers often overlook this historical link. Actually, it seems impossible to have an appropriate understanding of Leibniz’s philosophy without his connection with China. It seems to me that he is an ‘alternative’ in the history of Western philosophy for he introduced an oriental organic and naturalistic worldview especially in his doctrine of possible worlds (Liu 2004).

4 Modal information theory (MIT): A new synthesis

Formal logic opens up a tremendous promise for its application to both information and computer science (ICS) and information and communication technology (ICT). It can be imagined that this theory will still have more important roles to play in the development of quantum information science and it will be a substantial step towards the realization of the idea of building quantum computers. Albert Einstein once said that it was difficult to understand the meaning of a concept when it became more and more universal and came into the horizon of people more frequently. Hence, it would be necessary to carry out inquiry from different perspectives, which would result in more achievements. It seems that information is such a ‘magic’ concept we have ever encountered. However, its ontological position is not determined as yet from the present situation of inquiry. Just as Jon Barwise said, “the place of information in the natural world of biological and physical systems is far from clear” (Barwise and Seligman 1997, p. 11). It is not hard to see that on the very planet where we are living, i.e., “the natural world of biological and physical systems”, the position of information is still a problem to be settled. On the other hand, Floridi also employed the materialistic and idealistic dichotomy we are familiar with. He said,

Most people agree that there is no information without (data) representation… this principle is often interpreted materialistically, as advocating the impossibility of physically disembodied information, through the equation “representation = physical implementation”. The view that there is no information without physical implementation is an inevitable assumption when working on the physics of computation, since computer science must necessarily take into account the physical properties and the limits of the carriers of information. It is also the ontological assumption behind the Physical Symbol System Hypothesis in AI and cognitive science (Floridi 2004b, Liu 2004b).
This is obviously the materialistic view on information; however, it is also arguable that representation of information not necessarily requires a physical implementation. Floridi then goes to the idealistic scenario,

... environments in which there are only noetic entities, properties and processes (e.g. Berkeley, Spinoza), or in which the material or extended universe has a noetic or non-extended matrix as its ontological foundation (e.g. Pythagoras, Plato, Leibniz, Hegel), seem perfectly capable of upholding the representationalist principle without also embracing a materialist interpretation. The relata giving rise to information could be monads, for example (Ibid.).

Essentially, Floridi is arguing that if one drops the Descartes’ dichotomy, i.e., information is different both from physical/material and from mental, whether information itself could win an independent ontological category? It seems that he has no better way out so he has to come back to Wiener’s complaint that information is information. No materialism which does not admit this can survive at present (Wiener 1948, p. 132). It can be concluded that there is still no satisfactory solution to the position of information. To my knowledge, it appears that under the framework of Western philosophy with a long history of mind-body dualism, it is not likely to find an acceptable solution to the concept of information.

It seems that our problems encountered today are quite similar to those Leibniz met some three hundred years ago. Therefore, when the position of information is under discussion, we have to go back to Leibniz to make another new synthesis from an oriental perspective. Just as Heidegger pointed out that Leibniz “not only does the ancient and medieval tradition of logic converge in him in an independent new form; he becomes at the same time the stimulus for posing new questions, providing suggestions for tasks which are in part taken up only in recent times. From Leibniz we can create for ourselves perspectives reaching back to the ancients and forward to the present, perspectives important for the foundational problems of logic” (Heidegger 1978, 1984, p. 22). No doubt Heidegger’s evaluation on Leibniz is worth praising. But I would like to have a step further that in Leibniz there are not only converged ancient and medieval Western tradition, but also absorbed oriental, especially the tradition of Neo-Confucianism. In effect, Leibniz employed the thought of the Neo-Confucianism to make a new synthesis of the split of the Western philosophy. It can be seen that such a split cannot be integrated simply depending on pure Western philosophical elements or resources. The Neo-Confucianism is an organic knowledge on the nature, a theory of synthetic level, or an organic naturalism. The system of the thoughts of the Neo-Confucianism represented by Zhu Xi stands for the highest level of the Chinese philosophical ideas (Needham 1987, p. 61). However, it is just this point that has been ignored by the Western philosophers. Now, it is still necessary for
us to try to make a new synthesis on the concept of information from the oriental perspective.

I should say this situation is rather similar to that Leibniz met some three hundred years ago. For at that time, he also faced two irreconcilable conflicts of theological idealism and atomistic materialism, which never got a successful solution in the history of European thought (Needham 1980). Leibniz became a bridge maker trying to solve the antimony. Actually, Leibniz had already made a new synthesis prior to Kant. In effect, he introduced the organic worldview from the Neo-Confucianism to integrate the split he was facing (Liu 2004). That’s why I cherish Leibniz in the present situation of the ontological position of information.

After the establishment of semantics, the nature of the possible worlds has been widely discussed among logicians and various views have been proposed. Among which there are two famous realist interpretations, i.e., David K. Lewis’ radical realism (Lewis 1987) and Kripke’s soft realism (Kripke 1972). The radical realism is also called modal Platonism, a dualist interpretation in terms of Platonism, which was criticized and scorned as the ‘telescopic theory’. While Kripke proposed the soft realism in respect to Aristotle’s logic and the possible worlds were understood as Aristotle’s ‘potentia’, and in Aristotle’s logic the predicate is actually assigned as ontological. Therefore, his logic in effect focuses on the predicate. Now that Kripke is in line with the ontological position of the predicate, he is sure to be in favor of Aristotle’s ‘potential infinity’ rather than the ‘actual infinity’ in the classic logic. Kripke’s interpretation eliminates the possible worlds in reality, which is understood as possible states of affairs. Therefore, it is nothing but an ex post facto interpretation. It should be pointed out that these two interpretations were entirely given in the framework of the Western philosophy so as to approach Leibniz’s philosophy too narrowly to encompass his profoundness.

Now we are going to open an organic approach to comprehend Leibniz’s theory of possible worlds from an oriental perspective. I think that possible worlds could be viewed as worlds in information. This would be an interpretation of modal information theory (MIT) or modal informationalism (MI). According to Leibniz’s idea, the number of possible worlds is infinite, then we apply the notion of actual infinity into the possible worlds, i.e., the ‘abstraction of actual infinity’ employed in the single-world assumption is employed in the multiple worlds assumption. The notion of infinity is no longer seen as an infinitely-extending process, as it was; rather it is seen as a finished totality, or just ‘allatonceness’. In this way, ‘infinite’ would be seen as ‘finite’; alternatively we could treat the ‘infinite problems’ with ‘finite methods’. As far as human beings do not have a position of God, we don’t have God’s eye to view all of the details at one time. Therefore, the axiomatic method could only be confined to a certain model. Models are artifacts by which we could investigate those essentially
non-constructive objects. Conversely, we would be able to have an infinite
possibility in constructive capability. It is necessary to point out that MIT I
proposed is different from the classic logic, in which the four dogmas
of nonempty of individual domains, two-valued and extensional are not necessary
and sufficient conditions and actual abstraction is applied in the possible worlds
rather than the real or natural world. This is because the possible worlds in our
horizon no longer limited to the physical or ‘natural’ world. On the contrary they
are informational and metaphysical worlds. And this could ensure the plurality
of subjects and analyticity of all propositions. This is coincident with Leibniz’s
subject-predicate logic from where his metaphysics is derived, i.e., subject is in
the possible worlds and predicate in the actual world. Just as Leibniz put it, “…
every predicate, necessary or contingent, past, present, or future, is comprised in
the notion of the subject…” (Leibniz 1686). In effect, in Leibniz’s Monadology,
each monad represents a unique perspective, and in the totality of monads, each
monad has to be accepted. This can be explained via the law of sufficient reason.
To my understanding, each monad or perspective stands for a unique modal and
what’s more, not a single perspective or modal can be partitioned by more than
one monad. Otherwise, the chances for larger changes would be missed.
Ross once gave out an interesting example to show the constructively infinite
possibility, as he puts it like this,

A better model of Leibniz’s system would be an elaboration of the example of
the cube. Computer graphics can be used to create animated film sequences
representing the changing shapes and positions of imaginary objects from
particular perspectives. We can imagine an infinity of such films, each from
infinitesimally different viewpoints, all being run simultaneously. Even though
the objects and their interactions are entirely fictional, it will be as if there had
been infinitely many cameras filming one and the same scene from different
points of view. The simplest way of describing what they portrayed would be
by adopting that fiction, even though its only reality would be as a formula in a
computer program. But although this formula would not be real in the sense of
having a physical embodiment outside the computer, it would be objective.
It would be the only representation not biased towards one or other perspective,
and all the others could be derived from it (Ross 1984, p. 98).

Actually, this example shows the ubiquitous applicability of general-purpose
manipulations of Yi itself or just as Moor terms ‘logical malleability.’

Logical malleability has both a syntactic and a semantic dimension. Syntactically,
the logic of computers is malleable in terms of the number and
variety of possible states and operations. Semantically, the logic of computers
is malleable in that the states of the computer can be taken to represent anything
(Moor 1985).
This sense of ubiquity, where information is supposed to be capable of taking any form, discloses the complexity and ramifications of the possible worlds. The meaning of the possible worlds is determined by its interpretations. In our interpretation, information is given an ontological position in the possible worlds. But such an interpretation of ‘ontology’ is oriental rather than occidental. In our approach, the possible worlds could be an alternative interpretation considering a line of filiation of Leibniz’s lifelong relationship with China. Actually, many of Leibniz’s ideas were too radical to be accepted for his own age. Therefore, it would be rash and irresponsible to judge him merely by those ideas that have subsequently become part of our worldview. As with all great philosophers, his works no doubt contains hitherto unrecognized potential, and this is true in the case of PI.

5 Foundation for the future Chinese philosophy of science and technology

One of the important features for modern science is to construct the adaptive milieux for scientific theories. The studies in the philosophy of science showed that the model theory initiated by Polish logician Tarski in the 1930s plays an important role in modern science. Model theory studies the relationship between the formal language and its interpretations. It is more adaptive to modern science than the axiom theory to elaborate scientific theories. The reasoning in model theory belongs to analogy, whereas that in axiom theory is in the kind of deduction. Compared to innovation, there are obvious deficiencies in the latter. Philosophically, analogy is ampliative reasoning, i.e., its conclusion has more information than its premise, so that it is obviously contrasted with that conclusion which is already contained in the deductive reasoning. In model theory, the theory is viewed as a cluster of model isomorphic to either experience or imagination, and various relations among theories and objects could be explained by the concept of analogy or similarity. Analogy is to show that a group of objects in limited number shows likeness in many aspects, and it would probably show the likeness in another aspect so as to find out the likeness of various structures, i.e., the process of finding out the isomorphic structures means a process of finding out some unobserved propositions from the original observation statement. And these inferences would become new initial propositions so that more and more properties would be found out. Ronald N. Giere goes even further that ‘scientific reasoning is to a large extent model-based reasoning. It is models almost all the way up and models almost all the way down (Giere 1999, p. 56).

Physically, the significance of modeling lies in taking theories as a cluster of models isomorphic to observations. Theories are expressed by models rather than
Philosophy of information and foundation for the future Chinese philosophy

axioms, and the concept of isomorphism is used to explain the mathematical and physical relationships between theories and objectives. The largest significance of finding out the relations among the isomorphic structures is that we could apply calculations to the knowledge we have already known, just as arithmetic operations, deducing the facts from experience with isomorphic structures. There is another advantage for the model method, i.e., many of the structures corresponding to the unreal factors can be contained in the model. Model, as a logical calculus of theories, is an idealized form of theories, in which not all of the variables in the formal system are required to be existent in our real world, but they can be logically inferred in their sets. The logical function for the model rests on the continuation of a series of propositions that were not observed and from which new initial propositions would be resulted in so that more and more observable properties would be revealed.

Now let us turn to Leibniz again. As we have already known that he had a lifelong interest in China’s Neo-Confucianism. At the same time, he was also very much interested in Yiijing. Zhu Xi, the representative of the Neo-Confucianism made tremendous contributions to China’s history, especially his comments on Si Shu (The Four Books). However, the metaphysical foundation of the Neo-Confucianism is just Yiijing and Zhu had spent his whole life in the elaboration of Yiijing (Chen 2000, p. 2). It is arguable that China’s philosophy is informational, especially the classic of Yiijing. I would rather agree to some extent to this point.

But due to its strong propensity to the divination or fortune-telling, this classic would always become the focus of superstition in different times. But I would rather think that one of the real essentials of Yiijing is its model-theoretic construction of theories and the relevant analogical calculus and inferences. The feature of model-theoretic calculus in Yiijing has impacted profoundly on the mind-set among the Chinese. Dong Guangbi once said that one of the features of the traditional science in China is nothing but the modeling mind-set of Yiijing (Dong 2003). Accordingly, China’s theories are categorized as the tradition of modeling, while the Western theories are classed as that of axiomatization. This is a distinctive feature to differentiate two classes of scientific theories, and the significance is not only a breakthrough of whether there was science in China’s traditional culture, but also, in my opinion, would become the possible foundation to construct the future philosophy of science and technology of China At the same time, it would be helpful to envisage the development of science and technology at present and in the future. It can be seen from the contrasted perspective of East and West that the difference emerges from the theoretical expression, while the difference of the expression sprouts from the philosophical foundation of the views on nature and their impact on the logical make-up and mode of theoretical construction.

Dong also gave interpretations in terms of modern mathematics on the symbolic system, i.e., the hexagrams in Yiijing, in which Leibniz’s works on the
hexagrams in *Yijing* was taken as a pure mathematical inquiry. Dong’s conclusion that it has to be acknowledged that there ought to be three schools in the inquiry of *Yijing*, along with the traditional ones, i.e., *xiangshu* and *yili* schools in the native land of China, and there ought to be a *shuli* school (Dong 1987). Dong employed the phrase ‘ought to’, in other words, it is still to be identified whether there is a *Shuli* school in the studies of *Yijing* as this school is often confused with the *Xiangshu* school in the native land of China. However, he has encompassed Leibniz into the realm of the inquiry of *Yijing*. It is obvious that this vision is not only historical but also global and worldwide, as Leibniz is regarded to be the first to acknowledge the independence and value of other civilizations and cultures (Poser 2002). Especially in today’s globalization and information age, it is wise and insightful to adopt a pluralist dimension in metaphilosophy. In this sense, I would agree with Dong’s opinion, i.e., there is a *Shuli* school in the inquiry of *Yijing*. However, this school was not developed in the native land of China, or at least it is not the mainstream in the studies of *Yijing*. On the contrary, the *Shuli* school got developed vigorously abroad in the Western world since it has not been suppressed by the *xiangshu* and *yili* schools. The *Shuli* school made contributions to the transformation of the traditional logic and it can be envisaged that it will still have a tremendous promise in the days to come. In my opinion, it seems that China’s *Yijing* provided arguments and supports for the transformation of the Western scholarship to some extent, e.g., Leibniz’s works on the Aristotle’s logic and his binary interpretations of the hexagrams in *Yijing* are outstanding witnesses.

Now, how to reconcile the *Shuli* school with our academic resources becomes one of the new and heuristic subject matters. We should also adopt a ‘rear-view mirror’ to look into our present. However, where to find this ‘rear-view mirror’? It is just the achievements in the Western thought, philosophy and science, etc. Zhang Shiying, a scholar on Hegel, points out in his recent book that it seems that lots of precious things are still asleep in our traditional philosophy, and they should be aroused by Western thoughts. Whenever they are awake, they could be more fascinating than those that aroused them (Zhang 2004, p. 523). And the aroused would inevitably become the foundation on which the future Chinese philosophy of science and technology rests.

**References**


Philosophy of information and foundation for the future Chinese philosophy


Liu Gang (tr.) (2002). What is the philosophy of information? World Philosophy (Beijing), 16(4): 73–80


Liu Gang (2004). Cyberphilosophy and a Possible Foundation for the Future Oriental Philosophy of Techno-science in a Framework of Metaphilosophical Pluralism, A keynote presented at Section 4 Modernization and Intercultural Communication in the Cyberage: A Philosophical Inquiry held at Chinese Academy of Social Sciences on afternoon of November 20th, during the 27th General Assembly of the International Council for Philosophy and Humanistic Studies (CIPSH), International Social Sciences Council (ISSC) and Chinese Academy of Social Sciences (CASS) Meeting on Cultures and the Internet, Beijing November 19–20, 2004