

The *Yijing* (易经) and Cybernetics : From Leibniz's *Xiantian tu* (先天图) to Wiener's Bergsonism

“The thought of every age is reflected in its technique.” (Weiner, 1961, 38)

Introduction:

Cybernetics and the *Yijing*?¹ Why do these two seemingly unrelated terms appear together?

Perhaps, the real question is, why wouldn't they? One was born in the twentieth century West, dealing with the system of feedback and communication; the other emerged in the mytho-historical time of the East, studying the system of fluctuation and transformation. One originated from the exchanges between the numerous fields of modern science, technology, and humanities, and paved the way for the advent of today's information age by underpinning fields such as information theory, computational science, artificial intelligence, and cognitive science; the other originated from the ancient observations of the mysteries (蹟) and activities (动) of the cosmos and human society (*Xici*, A8:1-2), and has had a profound impact on the development of philosophy, science, technology, medicine, and art in East Asia and even in the modern Western world. As long as there is communication and transmission between these cultures and traditions, these two terms are bound to be connected in some way. Then, the question becomes, why should we care about their connection?

¹ The *Yijing* (*I Ching*, *the Book of Change*, or *Yi*) is a diachronic textual-diagrammatic system that includes three main works (三易) and Ten Wings (十翼) or ten commentaries. Of the three main works, the two from the mytho-historical period have been long lost, viz., *Lianshan Yi* (连山易) and *Guicang Yi* (归藏易), which are respectively attributed to two mythical sage rulers and culture-heroes, Fu Xi (伏羲, trad. 29th century BCE) and the Yellow Emperor (黄帝, trad. 27th century BCE). Therefore, the main work of the *Yijing* normally refers to the *Zhouyi* (周易) from the Western Zhou period (1000–750 BC), which is traditionally attributed to the Zhou cultural heroes King Wen of Zhou (1152–1050 BC) and the Duke of Zhou (1152-1056 BCE). The Ten Wings is a set of ten commentaries on the *Zhouyi*, which is traditionally attributed to Confucius, but is arguably written after Confucius. Of the Ten Wings, *Xicizhuan* (系辞传) is arguably the most important, which plays a central role in the Confucian reception of the *Yijing*. In this essay, when I mention “the *Yijing*” or “the *Yijing* system”, I refer to the *Zhouyi* and the Ten Wings. Relatedly, when I use “the *Yijing* tradition,” I mean to refer the *Yijing* system as well as its history of interpretation in Confucian tradition.

In his recent article, “On the Limit of Artificial Intelligence” (2021), featured in the special issue of *Philosophy Today* (Vol. 65, No.2) entitled “Philosophy after Automation,” Yuk Hui (who is also the editor of this special issue) discusses how cybernetics advanced the understanding of machine intelligence by facilitating the transition from the Cartesian “soulless” automatism to the organic recursive mechanism, but also how the dominance of digital recursive machines threatens to reduce the totality of reality to computational models. In discussing the limits of cybernetic and artificial intelligence, Hui proposes not only to re-think Henri Bergson’s question about mechanism and vitalism, which Norbert Wiener, the father of cybernetics, believed he had overcome in developing the theory of cybernetics, but also to “explore other ways in line with Bergson and beyond Bergson,” which, for Hui, means to rethink intelligence and mechanization through “technodiversity” and “noodiversity (the diversity of thinking and creativity)” (Hui, 2021, 12). According to Hui, technodiversity and noodiversity aim to bring “different orders of magnitude” and “difference levels of abstraction” from various cultural, traditional, and cosmological backgrounds to examine the premises and implications of intelligence and technology, thus saving the understanding of intelligence and technology from homogenization and synchronization (Hui, 2021, 12; c.f. Hui, 2020, 17-32). Although, in his article, Hui offers only a preliminary approach to understanding intelligence beyond computability through his strategic reading of the New Confucian philosopher Mou Zongsan, I do think his advocacy of technodiversity and noodiversity is instructive for approaching the issues of cybernetics, and that a comparative study of the *Yijing* and cybernetics can provide a substantial contribution to this view.

However, during my research, I found that technodiversity and noodiversity may have existed long before they were theorized as a post-modern, post-colonial intellectual task that

produces encounters between different metaphysical and “cosmo-technological”² traditions. They may have already been integrated into the development of techniques and ideas of any tradition. At least, the history of cybernetics indeed contains the influences from non-Western philosophy and technology, for example, from the influence of the *Yijing*. In modern Western history, Gottfried Wilhelm Leibniz was named by Wiener as “a patron saint of cybernetics out of the history of science,” as Leibniz’s philosophy of universal characteristic and his calculus of reasoning “contain the germs of the *machina ratiocinatrix*, the [organic] reasoning machine.” (Wiener, 1961, 12). Moreover, Leibniz’s systemization of binary arithmetic and his discovery of algebra of concepts directly influenced the development of the Boolean algebra and further influenced Claude E. Shannon’s digitization of the Boolean algebra through the binary properties of electrical switches, which now serve as the basic operating logic of all electronic digital computers. In other words, Leibniz’s philosophy and science had a direct influence not only on the development of cybernetics, but also on the choice of binary digits (bits) as minimal unit of information for the cybernetic machines. While Leibniz’s influence is not much emphasized in today’s cybernetics research, what is perhaps even less known (at least in the field of cybernetic studies) is the indispensable influence that the *Yijing* brought to Leibniz’s binary arithmetic and his universal characteristic projects.³ In the *Explication de l’Arithmétique binaire* (1703), Leibniz’s essential publication on the binary arithmetic system, Leibniz devotes half of the article to a discussion of the connection between the *Yijing* symbols and his binary system. Such connection, as Leibniz suggests, not only reflects the universal applicability and metaphysical

² Following Hui, I use the term “cosmo-technics” to emphasize the heterogeneous development of technology throughout human history. In other words, technical ideas should be studied and compared according to the different cosmologies in which they are embedded.

³ As a leading sinologist of his time, Leibniz had a life-long engagement with Chinese thought and devoted his considerable energy and political skills to engaging and encouraging cultural exchange, a topic that remains strange and peripheral to the philosophical and historical studies of his time. On Leibniz’s engagement with China, see F. Perkins, *Leibniz and China: A Commerce of Light*, New York: Cambridge University Press, 2004.

importance of his binary system, but also indicates the possibility of using Chinese writing as a promising sample for his universal characteristic.

While Leibniz's interpretation of the *Yijing* was largely limited by his time, it reveals a striking analogy between the *Yijing* hexagram system and his binary system, which opens up the possibility of discussing the substantive connections and differences between the *Yijing* system and cybernetics. Hence, I start by examining the history context of Leibniz's interpretation of the *Yijing*. Based on the *Xiantian tu* (先天图)⁴ received from the Jesuit missionary Joachim Bouvet (白晋) in 1703, Leibniz identified a formal analogy between his binary arithmetic and the *Yijing* hexagram system. Although this formal analogy was strategically demonstrated by Leibniz to prove the usefulness of his binary system, I argue that it reveals some profound connections between the two systems at both the metaphysical and practical or cosmo-technological levels. While contemporary scholars focus on the historical and metaphysical premises that support Leibniz's interpretation of the *Yijing*, I choose to examine the cosmo-technological connections between the two systems, because the significance of the hexagram system and the binary system is more comprehensively expressed in their cosmo-technological uses. Thus, in the second half of the paper, I shift my attention to the comparison between the *Yijing* divination and Wiener's cybernetics. By examining the structure of information feedback shared by cybernetic automata and the *Yijing* divination, I demonstrate the fundamental difference in their implicit views of the mechanism-organism relationship. Such difference leads to two radically different answers to Bergson's question about mechanism and mysticism – one claims a “complete defeat” of vitalism, while the other provides a promising model that integrates mechanism with mystical

⁴ The *Xiantian tu* (先天图; “the precelestial diagram”) was first recorded in Shao Yong's (1011-1077) *Huangji Jingshi shu* (皇极经世书), which demonstrates an organized system of the eight trigrams and sixty-four hexagrams according to the Fu Xi or *xiantian* (“pre-celestial”) order.

moral energy. At the end of the paper, I bring back the discussion of the formal analogy to imagine a potential re-union between the *Yijing* and cybernetics in a future, where the real world is not reduced to its digital computability but shows itself as an intelligible chaos.

I. Leibniz's Letters

In 1703, the *Explication de l'Arithmétique binaire* appeared in Paris's *Journal de l'Académie royale des sciences*. The English full title of this article is the "Explanation of Binary Arithmetic, which uses only the characters 1 and 0, with some remarks on its usefulness, and on the light it throws on the ancient Chinese figures of Fu Xi" (GM VII, 223). In fact, in 1701, Leibniz had already sent an article on his binary system entitled *Essay d'une nouvelle Science des nombres* to Bernard Le Bovier de Fontenelle, who was the perpetual secretary of the Royal Academy of Sciences in Paris. However, at Fontenelle's suggestion, Leibniz decided not to publish his article until he found "better samples" (des meilleurs échantillons) to prove the usefulness of his binary system.⁵ The decisive "sample" Leibniz was waiting for was a letter from Joachim Bouvet, a Jesuit missionary in Beijing, in which Bouvet proved the correspondence between Leibniz's binary arithmetic and the enigmatic figures of Fu Xi.

In his earlier letter to Leibniz in 1698, Bouvet first mentioned the symbols of the *Yijing* system, which Bouvet characterizes as "the first characters of this nation composed of small whole and divided horizontal lines [namely the *yang*, whole line (—) and the *yin*, divided line (- -)], whose invention [the Chinese] attribute to Fu Xi"⁶ (CB Letter E, 10). Leibniz showed great

⁵ See G. Leibniz, *Lettres et opuscules inédits de Leibniz précédées d'une introduction*, edited by Foucher de Careil (Paris, 1854), 204-209.

⁶ Fu Xi (trad. 29th century BCE) is a mythical sage ruler and culture-hero in Chinese legend and mythology, who is believed as the inventor of early science and technology, such as music, hunting, cooking, divination, and Chinese writing (the last being the one most emphasized by Bouvet and Leibniz).

interest in Bouvet's discovery, and he believed that "a means could be found to combine [the dyadic] with the ancient characters of the Chinese." Therefore, in his reply to Bouvet in 1701, Leibniz exposed to Bouvet the principles of his binary arithmetic and wanted Bouvet to inform him the detailed system of the *Yijing* symbols. Bouvet sent his reply to Leibniz in the same year, in which he confirms the "same marvelous harmony" (CB Letter I, 5) that he identified in both Leibniz's binary system and the *Yijing*/Fuxi's system. In demonstrating such correspondence, Bouvet not only explained to Leibniz how the "double geometric progression"⁷ of the *Yijing* matches the numerical progression of the binary system (see Fig. 1), but also sent Leibniz the *Xiantian tu*, a diagram composed of the round and square diagrams of the sixty-four hexagrams, plus Bouvet's annotation on the correspondence between the hexagrams and the dyadic (see Fig. 2). Leibniz did not receive Bouvet's letter until April 1, 1703. Six days later, Leibniz sent a new version of his article to the Paris Academy for publication as the *Explication de l'Arithmétique binaire*, the second half of which explains the analogy between his binary system and the symbols of the *Yijing* system.

⁷ This progression was first recorded in the *Xicizhuan*, which depicts the progression of the hexagram system from *taiji* (太极, the Great Ultimate, the source of the *yin* and *yang*, which Bouvet describes as "the first principle and the transcendent being" (CB Letter I, 11)), to the differentiation between the *yin* and *yang* lines (阴阳两仪), then to the four images (四象, the four patterns of stacking two lines, representing the four stages of the *yin-yang* changing), to the eight trigrams/*gua* (八卦, the eight patterns of stacking three lines, representing the foundational figures or *gua* (卦) of the *Yijing*/Fuxi's system), and finally to the sixty-four hexagrams (六十四卦, the sixty-four patterns of stacking two trigrams; the *Yijing* system is developed from the reading of these sixty-four hexagrams). Noting that Bouvet adds two extra stages to the progression, namely the sixteen patterns of stacking four lines, and the thirty-two patterns of stacking five lines. Although the stack of four and five lines has no significance in the *Yijing* system, they are helpful for demonstrating the continuity between the progression in the *Yijing* and the numerical progression in the binary system (see Fig. 1).

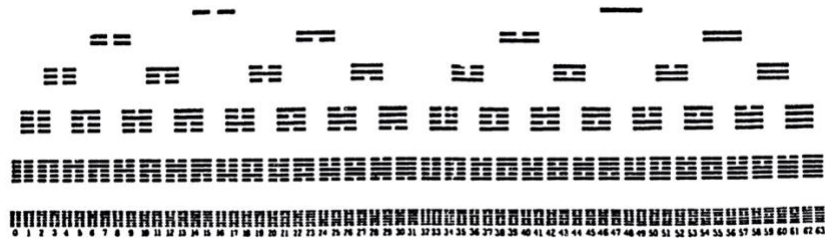


Fig. 1. The “double geometric progression” of the *Yijing* system in the binary system (Ryan, 1996, 67).

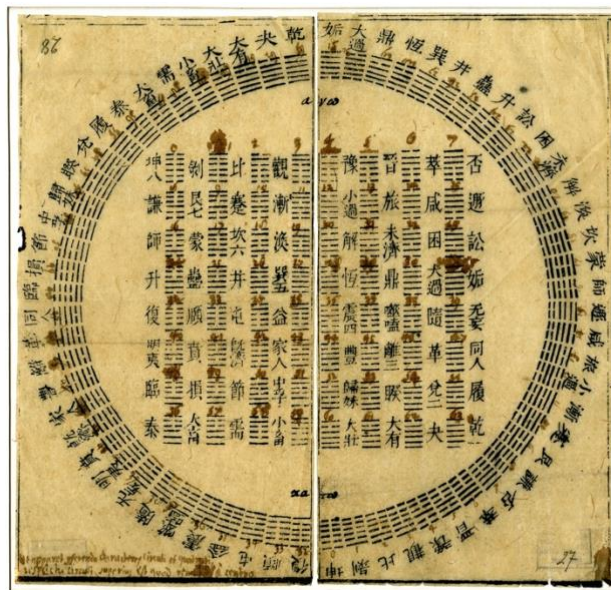


Fig. 2. Diagram of the *Xiantiantu* sent by Bouvet to Leibniz with his letter of 4 November 1701. Source: “Leibniz-Bouvet Correspondence,” edited by Alan Berkowitz and Daniel J. Cook. <https://leibniz-bouvet.swarthmore.edu>

Both Bouvet and Leibniz’s engagement with the *Yijing* was strategic. Bouvet’s approach to the *Yijing* was prompted by his Figurist ideal, namely that all cultures spring from the ancient Judeo-Christian line; therefore, the study of Chinese ancient texts could reveal predictions and intimations of Christian teachings and mysticism (Ryan, 1996, 59-62). In his 1698 letter, Bouvet first characterizes the *Yijing*/Fuxi’s system as a remnant of forgotten ancient Chinese science, and then advocates a search for “the true comprehension of this system or of these characters [which] could serve greatly not only to bring back perhaps all this nation [i.e., China] to the knowledge of the true God, but also to establish the natural method that one must follow in all

the sciences” (CB Letter E, 11). Bouvet’s Figurist and universalist approach to the *Yijing* inspired Leibniz’s use of the *Yijing* for his research on binary arithmetic and universal characteristics.⁸ In a letter sent to Duke Rudolph of Brunswick in 1697, Leibniz maintains that his binary system, “the simple and unadorned presentation of One and Zero or Nothing,” best presents and demonstrates “the creation *ex nihilo* through God’s almighty power.”⁹ The *Yijing* hexagram system helps Leibniz to concretize the connection between binary arithmetic and God’s creation *ex nihilo*, as it shows how the myriad things could emerge from the interaction of the *yang* line, the “1” as God’s oneness, and the *yin* line, the “0” as absolute nothingness. Moreover, in Leibniz’s interpretation, the hexagram system not only embodies a form of binary arithmetic, but also contains characters that are directly linked to ideas, which led Leibniz to regard it as a promising sample for his project on universal characteristic (a project aimed to explore a universal formal language that functions as a *calculus philosophicus* to judge controversies and express systematic knowledge) (Maitre, 2022, 32). Thus, Leibniz concluded his 1703 article by emphasizing the need for more discoveries on “the foundation of Chinese writing,” as he expected to understand Chinese writing as universal characters derived from the arithmetic rules of the hexagram system (GM VII, 227).

Although the *Yijing* symbols play a crucial role in Leibniz’s research on binary arithmetic, especially between 1701 and 1707, Leibniz’s understanding of the *Yijing* was very

⁸ For a specific discussion on the relationship between Leibniz’s research on binary arithmetic, universal characteristics, the *Yijing* symbols, and Chinese writing, see M. Maitre, “The Development of Binary Arithmetic by Leibniz: Influence or Independence regarding the *Xiantiantu* of Shao Yong,” in *Journal of East-West Thought June* (Pomona: California State Polytechnic University, 2022), 17-37.

⁹ In 1697, Leibniz sent a medallion inscribed with numbers in his binary system to Duke Rudolph of Brunswick, writing: “After all, one of the high points of the Christian faith, which agrees least with the philosophers and is not easy to impart to pagans, is the creation *ex nihilo* through God’s almighty power. Now one can say that nothing in the world can better present and demonstrate [this power] than the origin of numbers, as it is represented here through the simple and unadorned presentation of One and Zero or Nothing.” J. Ching and W. Oxtoby, *Moral Enlightenment: Leibniz and Wolff on China* (Nettetal: Steyler Verlag, 1992), 72. C.f. Perkins, *Leibniz and China*, 116.

limited, which was largely shaped by Bouvet’s strategic introduction that reduces the *Yijing* to the diagrammatic figures of Fu Xi. Leibniz never talked about the *Zhouyi* in his letters, the main text of the *Yijing* system on the specific reading of the sixty-four hexagrams (see footnote 1), not to mention the complex transformation and reception of the *Yijing* in Chinese traditions. Even the correspondence between Leibniz’s binary system and the hexagram system is far from “the truth” that “leaves no further room to doubt” as Leibniz claims in his 1703 article (GM VII, 226). In fact, many scholars have concluded that the resemblance between the two was “purely formal” (Aiton&Shimao, 1981, 89; c.f. Ryan, 1996, 67). The decisive document supporting Leibniz’s “truth” is the *Xiantian tu* sent by Bouvet, in which the striking correspondence between the hexagrams and binary numbers makes sense only under two premises: a) seeing the *yin*/broken line (- -) as 0 and the *yang*/whole line (—) as 1, and b) reading the lines of the hexagram from top to bottom corresponding to the digits of the binary number from right to left (see Fig. 3).





Names of hexagram	Figures of hexagram	Binary numbers	Decimal numbers
坤 <i>Kun</i>		000000	0
剥 <i>Bo</i>		000001	1
比 <i>Bi</i>		000010	2
... ..			
乾 <i>Qian</i>		111111	63

Fig. 3. Chart of the correspondence between the hexagrams and binary numbers in Bouvet-Leibniz’s *Xiantian tu*

The most obvious problem of such reading is that the *Yijing* tradition always reads the lines of each hexagram from the bottom up, and considers the innermost line as the first line (初爻), whereas the diagram's correspondence to the binary system implies that the outermost line of each hexagram is read first. According to Alan Berkowitz and Daniel J. Cook (the editors and translators of the Leibniz-Bouvet correspondence), Bouvet was an expert on the *Yijing*, and he clearly understood that the progression of the lines should be read from bottom to top. Therefore, Bouvet's purposeful reading of the hexagram from top-down shows that "Bouvet's interest here is purely in the diagrammatic form, and not in explaining how the hexagrams functioned within the *Yijing* in the Chinese world" (CB Letter I, 6, footnote 3).

Furthermore, to directly recognize the analogy between the hexagrams and the binary numbers, it is natural to assume the correspondence between the *yin* line and "0" and the *yang* line and "1." Neither Bouvet in his 1701 letter nor Leibniz in his 1703 article justified such correspondence – they present it as a given premise to bring forward the analogy, and, at the same time, emphasize that the Chinese have lost the original meaning of the figures of Fu Xi, so "the true explanation now has to come from Europeans" (GM VII, 226; c.f. CB Letter I, 10). However, in the *Yijing* tradition, *yang* and *yin* always come with terms that describe the state and quality of specific things, such as activity and stillness (动静), firm and yielding (刚柔). *Yang* and *yin* can also directly refer to a pair of things or phenomena with opposite characteristics, such as sun and moon (日月), summer and winter (寒暑), and heaven and earth (天地). According to Zhu Xi (1130-1200), a central thinker of the Neo-Confucian school and an influential interpreter of the *Yijing* in Chinese history, "hexagrams and lines, *yin* and *yang* are all 'within form' [形而下]" (ZYBY, 3-12: 3; Adler, 2019, 284), in contrast to the Way or *Dao* (道)

or principle (理), that is “above form” or “形而上,” the term used to translate “metaphysical.” In other words, while the binary numbers “0” and “1” represent the (onto-)theological and metaphysical states of nothingness and unity, *yin* and *yang* are more concerned with the force and state of specific things (物) or phenomena (象).

However, my emphasis on Bouvet and Leibniz’s formal interpretation of the *Yijing* is not to suggest the analogy they found between the *Yijing* and binary arithmetic is simply arbitrary, thus dismissible. Neither do I want to endorse the criticism that continued from Hegel to Derrida, which sees Leibniz’s interpretation as a “Chinese prejudice” or “European hallucination.”¹⁰ As Berkowitz and Cook argue, Bouvet and Leibniz’s reading of the *Xiantian tu* is “purely formal” but also mathematically “impeccable” (CB Letter I, 6, footnote 3). The “double geometric progression” of the *Yijing* (see Fig. 1), which is realized through the repeated divisions and permutations of the *yin* and *yang* lines, is mathematically equivalent to the numerical progression of the binary system.¹¹ Such mathematical equivalence is not merely a coincidence but can lead

¹⁰ On the relationship between Leibniz’s interpretation of the *Yijing* and Hegel’s and Derrida’s criticism, see E. Nelson, “The *Yijing* and philosophy: From Leibniz to Derrida,” *Journal of Chinese Philosophy* (August, 2011), 377 - 396. My reading of Leibniz’s interpretation is in line with Nelson’s argument that “Leibniz is one of the rare Western philosophers to recognize the Chinese script as having intellectual or rational aspects” (Nelson, 2011, 382), whose interpretation could lead to fruitful cross-cultural philosophical discussions, in contrast to later Western tendencies to read the Chinese writing as ahistorical and exterior to Western history and philosophy.

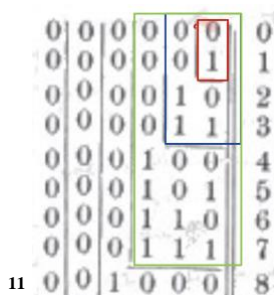


Fig. 4. Diagram of the numerical progress of the binary system.

This is an intercept of the diagram from Leibniz’s 1703 article (GM VII, 223). My annotation shows the mathematical equivalence between the progression of the hexagrams and that of the binary system: the group of

to fruitful discussions and comparisons of the two systems at both the metaphysical and practical or cosmo-technological levels.

At the metaphysical level, like Leibniz's binary progression, the "double geometric progression" of *yin* and *yang* also reflects the metaphysics of the production of the myriad things (化生万物), as the famous line from the *Xicizhuan* states:

"The alternation of *yin* and *yang* is called the Way. Carrying it out is good. Completing it is the nature [*xing* 性] ... Life and growth [*sheng sheng* 生生] are the meaning of change [*yi* 易][一阴一阳之谓道，继之者善也，成之者性也 ... 生生之谓易]" (*Xici*, A.5.1-6; Adler, 2019, 269).

Therefore, Bouvet and Leibniz are correct in highlighting the metaphysical underpinnings of the *Yijing* symbols, but their strategic readings assimilate "the alternation of *yin* and *yang*" (一阴一阳) too quickly into God's creation *ex nihilo*. The formal analogy between the *Yijing* and the binary arithmetic does not entail their metaphysical consistency as Figurism and universalism tend to believe, but should open towards more cautious and nuanced studies of the metaphysical premises of the two systems.

At the practical or cosmo-technological level, both the binary system and the *Yijing* system imply a *simple* and organized way to understand and analyze the myriad things and phenomena. For Leibniz, the binary system reflects the principles of simplicity and economy, as it generates and organizes the "characteristic number" of everything (GM VII, 221) with a continuous pattern constructed according to a simple rule. His universal characteristic is also an attempt to invent an economical knowledge or technique that is capable of expressing adequately and unambiguously the numerical essence of things. Likewise, one of the essential implications

numbers in the red square is equivalent to the *yin* and *yang* two lines (两仪), the group in the blue equivalent to the four images (四象), the group in the green equivalent to the eight trigrams (八卦).

of the term *Yi* (易) in the *Yijing* is simplicity, as the *Xici zhuan* says, “it is through ease and simplicity that one grasps the order/principle of all under heaven [易簡，而天下之理得矣]” (Xici, A 1.8; Adler, 2019, 264). The simplicity of the *Yijing* is reflected in its categorization of the myriad things through the eight trigrams and sixty-four hexagrams. The binary division and permutation of *yin* and *yang* determines the Fu Xi or *xiantian* order of the tri/hexamagrams.¹² Such order is crucial for the *Yijing* divination process, as it determines the result of divination based on the correlation between the trigrams and the numbers used for divination (specific divination process is discussed in the next section). However, the interpretation of divination results usually depends on the Wen Wang or *houtian* order, which is determined based on the empirical connections between the trigrams and the natural orientation and phenomena (such as weathers and seasons). Moreover, the description of the binary progression of *yin* and *yang* in the *Yijing* is always mixed with other counting systems, such as the ternary relation of heaven-earth-human (天地人) and the quaternary movement of four seasons (四时). In other words, the simplicity (易) of the *Yijing* is not equivalent to the arithmetic simplicity and economy of the binary system, for the former presupposes certain empirical understandings of nature and the place of

¹²Note that the progression of *yin* and *yang* only determines the Fu Xi or *xiantian* order, which posits the eight trigrams in “the domain prior to the generation of the cosmos.” Such order differs from the Wen Wang (文王) or *houtian* (post-celestial) order and orientation of the eight trigrams, which were extrapolated by King Wen of Zhou (1152–1050 BC) based on his study of the relationship between the trigrams and natural phenomena in “the domain in which the individual creatures, objects, and phenomena live, exist, and occur” (Pregadio, 2013, 3).

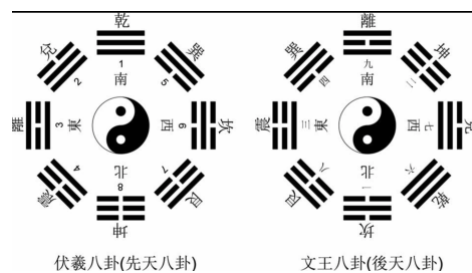


Fig. 5. Diagram of the Fu Xi or *xiantian* order (left) and the Wen Wang or *houtian* order (right).

human in the world. Therefore, while the binary system serves as the best presentation of (God's) creative power, the alternation of *yin* and *yang* is not sufficient by itself to fully embody the productive power or *sheng sheng* of the *Yijing*.

Thus, we can see that at both metaphysical and cosmo-technological levels, the *Yijing* and the binary arithmetic share certain crucial similarities that are not merely formal; however, these similarities lead us to a more profound divergence between the two systems, which require a comparative study of the two in their metaphysical and cosmo-technological totality.

Contemporary scholarship has made substantial advances in understanding the relationship between Leibniz and the *Yijing* in their historical context.¹³ However, these scholarly works tend to do comparative studies from a historical or philosophical angle. Even for those that explore the scientific and technical differences between Leibniz's system and the *Yijing*, these differences serve to better elucidate the philosophical differences between the two. The downplaying of technical and practical aspect may be due, on the one hand, to the academic tradition in comparative studies and, on the other hand, to the fact that Leibniz's binary arithmetic and universal characteristic had not yet received sufficient attention and application in his time.

However, nobody would deny the importance of Leibniz's projects in today's information age. As I suggested in introduction, the advent of cybernetics theory and recursive digital machines allowed Leibniz's projects to be realized in a broader context of theorization

¹³ D. J. Cook and H. Rosemont Jr., "The Pre-established Harmony between Leibniz and Chinese Thought," in *Journal of the History of Ideas* 42, no. 2 (1981), 253-267; J. A. Ryan, "Leibniz Binary System and Shao Yong's *Yijing*," in *Philosophy East and West* 46, no. 1 (1996), 59-90; F. J. Swetz, "Leibniz, the *Yijing*, and the Religious Conversion of the Chinese," in *Mathematics Magazine* 76, no. 4 (2003), 276-291; F. Perkins, *Leibniz and China: A Commerce of Light*, (New York: Cambridge University Press, 2004); E. Nelson, "The *Yijing* and Philosophy: From Leibniz to Derrida," *Journal of Chinese Philosophy* 28, no. 3 (2011), 377-396; M. Maitre, "The Development of Binary Arithmetic by Leibniz: Influence or Independence regarding the *Xiantiantu* of Shao Yong," in *Journal of East-West Thought* (Pomona: California State Polytechnic University, 2022), 17-37.

and application. Thus, a comparative study of the practical and technological operations of the hexagrams and the binary system in their native system, i.e., the *Yijing* divination system and the system of cybernetics, allows for a substantial expansion of their formal analogy. Such comparison can be further directed to an illumination of how these technological applications relate to their underlying metaphysics, and ultimately how these two (already intertwined) systems connect to each other in a metaphysical-cosmo-technological wholeness. Since a comprehensive discussion of the technological operations of the two systems would easily exceed the capacity of this paper, not to mention a further discussion of their underlying philosophy, I would like to provide a tentative demonstration of the comparative journey I outline here by focusing on the basic structure of the *Yijing* divination and Wiener's account of cybernetics.

II. Communication automata, steersman, and the *Yijing* divination

The first chapter of Wiener's field-defining work, *Cybernetics: or Control and Communication in the Animal and the Machine* (1948), is entitled "Newtonian and Bergsonian Time," in which Wiener argues that the development of mechanism in the West has undergone a change from Newtonian, reversible, mechanical time to Bergsonian, irreversible, organic time. Such change marks an epistemological shift from linear causal reasoning to non-linear recursive thinking, which is consistent with the technological evolution of the modern West: "If the seventeenth and early eighteenth centuries are the age of clocks, and the later eighteenth and the nineteenth centuries constitute the age of steam engines, the present time is the age of communication and control" (Wiener, 1948, 39). A clock is a classic Cartesian or Newtonian automata for the seventeenth and eighteenth centuries, because each part inside the clock is connected through a

causal chain; and the time displayed by the clock is literally reversible. This linear mechanics is inherited in the age of thermodynamics, as Wiener writes, “from the Newcomen [steam] engine almost to the present time, the central field of engineering has been the study of prime movers” (Wiener, 1948, 38). Although thermodynamics makes its appearance in a science “in which time is eminently irreversible,” as theorized by the second law of thermodynamics (concerning the irreversibility of the combined entropy of system), the nineteenth-century thermodynamic engineering revolves around the conservation and degradation of energy, which still implies a linear understanding of mechanism derived from Newtonian dynamics.

It was not until the development of electrical engineering and the invention of the telegraph in the mid-19th century that people became interested in communication engineering. What distinguishes communication engineering from power engineering is that “[the former’s] main interest is not economy of energy but the accurate reproduction of a signal” (Wiener, 1948, 39). Communication engineering opens the possibility for a “newer study of automata,” since it connects automata to the external world, not just through the flow of their entropic energy, but through their “flow of impressions, of incoming messages, and of the actions of outgoing messages” (Wiener, 1948, 42). According to Wiener’s reading of Bergson, the difference between the reversible time of mechanics and the irreversible time of evolution and biology is that “nothing new happens” in the reversible time (for everything is predictable based on the causal chain), while “there is always something new” in the irreversible time (Wiener, 1948, 38). Therefore, the time for communication automata is no longer Newtonian reversible time, but Bergsonian irreversible time, since “something new” appears during their manipulation and transmission of information. However, as Wiener emphasizes, this “something new” does not mean radical or arbitrary new messages, but rather “variations” of information that are not

“completely determined by their past,” but still “conform to some sort of *statistical* regularity,” so that they can maintain effective and continuous communication and control between the automaton and the outside (Wiener, 1948, 10). To study the variations of information that occur in communication and control, one needs a statistical theory that studies “the amount of information” transmitted between probable alternatives. The name *Cybernetics*, from the Greek term *κυβερνήτης*, or “steersman,” is thus selected by Wiener and his team to define this entire field of control and communication theory.

For Wiener, cybernetics is a study of the information feedback that supports communication and control between automata and the external world. A cybernetic mechanism is a mechanism that can act on the information they receive from the outside, such as, using Wiener’s examples (note the obvious military tone), “automatic gyrocompass ship-steering systems, self-propelled missiles, anti-aircraft fire-control systems, automatically controlled oil-cracking stills” (Wiener, 1948, 43). According to Wiener, cybernetic automata establish information feedback with the outside through three steps: the automaton needs to first register certain information or “impressions” from the external world with their “receptor” or “subtractor,” then recombine the incoming “impressions” (which implies an adjustment of the information according to the average characteristic of the system through the “compensator”) into a form of signals that can be processed by the “effector,” and finally produce “a desired type of response” or performance of actions that can lead to a new feedback exchange (see Fig.6).

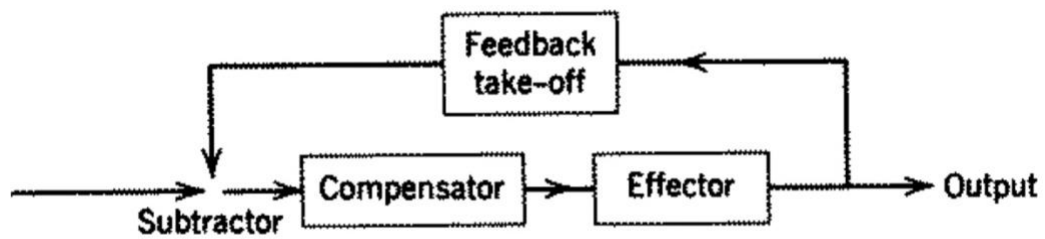


Fig. 6. Diagram of the general type of informative feedback of cybernetic automata (Wiener, 1948, 112).

These three steps constitute the general type of feedback for cybernetic machines. This kind of feedback, as Wiener emphasizes, “can certainly be found in human and animal reflexes” (Wiener, 1948, 113).

Based on this feedback structure shared between the organism and the cybernetic automaton, Wiener claims:

“The modern automaton exists in the same sort of Bergsonian time as the living organism; and hence there is no reason in Bergson’s considerations why the essential mode of functioning of the living organism should not be the same as that of the automaton of this type ... In fact, the whole mechanist-vitalist controversy has been relegated to the limbo of badly posed questions.” (Wiener, 1948, 44).

Wiener’s reading of Bergson is strategic. According to Yuk Hui, “Wiener did not really get Bergson right, because first of all vitalism is not exactly organism” (Hui, 2021, 4). Wiener’s account of communication automata is likely to fail to bridge the gap between mechanism and vitalism, because vitalism is not only about the functioning of the living organism, but also emphasizes a moral energy that resists the tendency towards closure. However, Wiener’s reference to Bergson’s vitalism is not primarily intended to unravel Bergson’s question about mechanism and vitalism, but to draw an important parallel between cybernetic automata and living organism, i.e., they both employ a non-linear information feedback instead of linear mechanical causality to arrive at a *telos*.

Nevertheless, if we delve into this parallelism, into Wiener’s specific description of the mechanism of cybernetic automata, we may find that this parallelism already assumes a biased mechanical assimilation of the organism. In the chapter on computing machines and nervous systems (which, for Wiener, serve as an exemplary pair of the parallel between the mechanical and organic information feedback), Wiener explicitly expresses his preference for “numerical

machines,” which process data on the discrete binary scale, over “analogy machines,” which measure data on continuously variable physical quantities, because the former is better suited for highly accurate work, whereas the accuracy of the latter is limited by the construction of the physical scale. According to Wiener, the accuracy and effectiveness of the computing machine is determined by its ability to “combine contingencies in accordance with a systematic algorithm.” Among the many algorithms, Boolean algebra, developed from Leibniz’s algebra of logic and binary system, stands out as the best, because it provides the “simplest” and most economical logical structure, i.e., “the dichotomy, the choice between *yes* and *no*” (Wiener, 1948, 118). However, in Wiener’s inheritance of Leibniz, the simplicity and economy of the binary system comes with its intolerance of non-binary, non-quantitative elements. As Wiener argues, to ensure the accuracy and effectiveness of computation, “the human element” should be removed from any elaborate chain of computation and “to perform all intermediate processes on the binary scale [in the form of “on” and “off” of high-vacuum tubes]” (Wiener, 1948, 118). In fact, for Wiener, even the “human element” can be reduced to binary functions, just as the mechanism of nervous system is essentially a binary state of “fire” and “at rest” of synapses. Any non-(binary-)neuronic influences are marginalized as variants of “incoming impulses,” which are effectively reduced to a “adequate” or “inadequate” state of synaptic firing.

The statistical and binary-arithmetical nature of Wiener’s cybernetic mechanism contrasts sharply with the mechanism of the *Yijing* divination, which regards “the human element” as an essential part of processing information feedback. Emphasizing both the numerical mechanism of the hexagram system and the human/organic interpretation of the *Yijing* system, the *Yijing* divination seems to draw a more equal relationship between organism and mechanism than Wiener’s mechanically biased parallelism. However, before we compare their views on the

mechanism-organism relationship, we shall first justify their comparability by demonstrating how the *Yijing* divination shares a similar structure of information feedback with Wiener's cybernetics.

If one must choose between Newtonian time and Bergsonian time for the *Yijing*, it is unlikely to be the former. A linear mechanical view of the world, a view that emphasizes on the role of the Prime Mover, is an epistemology deeply rooted in the Western onto-theology and cosmogony.¹⁴ One may argue that Bouvet and Leibniz's interpretation of the *Yijing* reveals a mechanical understanding of *yin* and *yang* as the primal force of creation. However, as I argue in the last section, *yin* and *yang* are not metaphysical force *in itself*. "The alternation of *yin* and *yang*" (一阴一阳) does not precede the myriad things, but is embodied in individual things, as well as in the relations and activities between different things, as Shao Yong writes, "*yin* and *yang* each embody the (specific state of) heaven-earth-human, and heaven, earth, and human each have their own *yin* and *yang* quality[阴阳之中各有天地人, 天地人之中各有阴阳]." (*HJJS*, 13A.21a). The mechanical tone implied in Bouvet and Leibniz's interpretation of the *Yijing* could be easily dispelled by shifting attention from the numerical structure of the hexagrams to their specific function in the *Yijing* divination system.

¹⁴ The contrast between European and Chinese technological cultures is often understood as a contrast between a mechanical view and an organic holistic view. As Joseph Needham famously argues, "the *philosophia perennis* of China was an organic materialism. This can be illustrated from the pronouncements of philosophers and scientific thinkers of every epoch [in Chinese history]. The mechanical view of the world simply didn't develop in Chinese thought, and the organicist view in which every phenomenon was connected with every other according to hierarchical order was universal among Chinese thinkers." J. Needham, "Poverties and Triumphs of the Chinese Scientific Tradition," in *The Grand Titration* (London: Allen & Unwin, 1969), 23. While the view of nature in Chinese thought must be distinguished from the question of nature as it was posed in the West, it is worth examining the extent to which Chinese thought implies an "organicist" view, and what are the connections and differences between "organism" in Chinese thought and Western organism.

As Zhu Xi claims multiple times in his *Classified Conversations* (朱子语类), “the Yi was originally created for divination [易本为卜筮而作]” (Adler, 2019, 11). The hexagrams have two essential functions in this system of divination: 1) they categorize and represent the myriad things; 2) they contain certain information about tendencies that can be used to predict the fluctuation and transformation (变化) in things. The eight trigrams represent the eight basic natural elements,¹⁵ as well as the eight flexible categories to which things belong: for example, the third trigram (according to the Fu Xi order) *Li* (离) means fire, which is associated with things that are bright, like lightning, rainbow, or eyes, but it can also represent something that is hard on the outside and soft on the inside, such as crab or armor, for the figure of *Li* has two *yang* lines on the outside representing the firm (刚), and one *yin* line on the inside representing the yielding (柔). The sixty-four hexagrams are more complicated: as recorded in the *Zhouyi*, based on the relation and position of the two stacked trigrams and the structure of the six lines, each hexagram is named after a specific phenomenon and is accompanied by a “judgement” (彖辞) that describes the overall auspicious or ominous state (吉凶);¹⁶ besides this overall judgement, each hexagram has six “lines”

八卦 Bāguà—The eight trigrams							
乾 Qián	兌 Duì	離 Lì	震 Zhèn	巽 Xùn	坎 Kǎn	艮 Gèn	坤 Kūn
☰	☱	☲	☳	☴	☵	☶	☷
Heaven/Sky	Lake/Marsh	Fire	Thunder	Wind	Water	Mountain	Earth
天 Tiān	澤(泽) Zé	火 Huǒ	雷 Léi	風(风) Fēng	水 Shuǐ	山 Shān	地 Dì

Fig. 7. Diagram of the correspondence between eight trigrams and eight natural elements

¹⁶ For example, the 11th hexagram (according to the Wen Wang order, or the 57th according to the Fu Xi order) is *Tai* 泰, which, as translated by Adler, means “penetrating.” This hexagram has the trigram heaven (*qian*) in the below and the trigram earth (*kun*) in the above. Since heaven is light and goes up and earth is heavy and falls down, the two elements [inter]penetrate, thus leading to the departure of “the petty” (the *yin* earth) and the arrival of “the great” (the *yang* heaven). Therefore, the judgment of this hexagram is “The petty depart, the great arrive: auspicious success” (Adler, 2019, 102). If you read “the petty” earth as the past, the “great” heaven as the future, this hexagram implies a change in time, so this is also the hexagram of the New Year.

(爻) representing six stages of transformation in the phenomenon, and each line has its own statement (爻辞) that indicates a specific state of auspiciousness or ominousness.¹⁷

As Wiener's communication automata, the trigrams/hexagrams also function as a special communication and control mechanism, which transforms the "impressions," or, in the context of the *Yijing*, "fluctuation and transformation" (变化) from the external world into some form of information for the diviner to interpret and process, and eventually leads to the production of new information, i.e., divination results and suggestions. In fact, the *Yijing* divination is perhaps closer to the original meaning of cybernetics, namely steersman, than modern cybernetic machines -- if we regard the starry sky as the connected hexagrams, and the swaying ship on the sea as the fate of human. However, the *Yijing* divination relies neither as much on human/organic experience of the sea as a steersman (I strategically downplay the importance of navigational tools here), nor as much on the computing mechanism as cybernetic automata; it emphasizes both the importance of mechanism and human understanding. The simplicity (*Yi* 易) of the *Yijing* is reflected precisely in how its hexagram mechanism makes infinite activities and fluctuations of the universe understandable and predictable *to a certain extent* for humans. The *Yijing* divination is thus a "simple" practice, despite its complicated and elaborate processes, to deal with the "difficult" unknowability and chaos.

There are many different schools and methods of divination in Chinese history, from the complex, ritualized yarrow divination recorded in the *Xicizhuan*, to the simple, quotidian spontaneous divination (based on the observation of numbers or images in life) performed by Shao

¹⁷ For example, the statement of the first line (from bottom up) of the hexagram *Tai* is that "pulling out thatch grass in clumps; going forth is auspicious" (Adler, 2019, 103). Thatch grass may imply the interconnectedness of the three *yang* lines at the bottom of the hexagram. The image of "pulling out thatch grass" implies the forward/upward movement of the *yang* lines, so it means auspicious.

Yong. Although containing very different processes and operations, they all emphasize the embodied experience of the diviner and their knowledge of the *Yijing* system. As a general process, the diviner first needs to function as a “subtractor” or “receptor” to perceive the “fluctuation” (变) in activities and to form a specific question or motivation for divination.¹⁸ Then, the diviner needs to perform certain methods related to numbers or images to divine a preliminary hexagram. The divination method also functions as a “compensator,” which adjusts the preliminary hexagram by determining its “fluctuated lines” (动爻),¹⁹ alternating these lines (from *yin* to *yang* or from *yang* to *yin*), and forming a new hexagram. Eventually, when the diviner gets a set of hexagrams as the divination result, they need to interpret the result and produce divinatory suggestions on the basis of: a) the “line statement” (爻辞) of the fluctuated lines and/or the “judgment” (彖辞) of the hexagram as recorded in the *Zhouyi* -- some of them have a clear auspicious/ominous statement, some of them not, but all of them are figurative and ambiguous, b) the diviner’s understanding of these “phrases” (辞) and “images” (象) (their reference, rhetoric, etc.) in the *Yijing* context, as well as the understanding of the relationship between the general *Yijing* text and the specific fluctuation, c) the diviner’s interpretation of the relationship between the hexagrams and the diviner’s embodied surroundings – every element in the environment can speak to the implied meaning of

¹⁸ One principle for divination, as recorded in the divination book *Meihua Yishu* (梅花易数) attributed to Shao Yong, is “no [perceived] fluctuation no divination, no [bothering] event no divination” (不动不占, 不因事不占). In other words, the effectiveness of divination depends on the degree of concentration of the diviner on specific fluctuation, as the concentrated and embodied experience connects, or even turns, the diviner and the divination result to the fluctuation.

¹⁹ Determining the fluctuated lines (动爻), which represent the specific changes that will occur in the divination event, is a crucial step in the *Yijing* divination. Depending on the method of divination, one or more (in few cases, zero) of the six lines of the preliminary hexagram (representing the current state of the event) will be identified as fluctuated lines. These lines will then be alternated, from *yin* to *yang* or from *yang* to *yin*, resulting in a new hexagram (representing the future development of the event). The line statements (爻辞) of the fluctuated lines often play a central role in the divination interpretation.

the hexagrams, d) the diviner's general knowledge and sense that makes all the above fit the context of the event.

If we compare this general divination process with Wiener's general information feedback, we may see a rough correspondence between the *Yijing* divination and the cybernetic mechanism, as shown in Fig. 8.

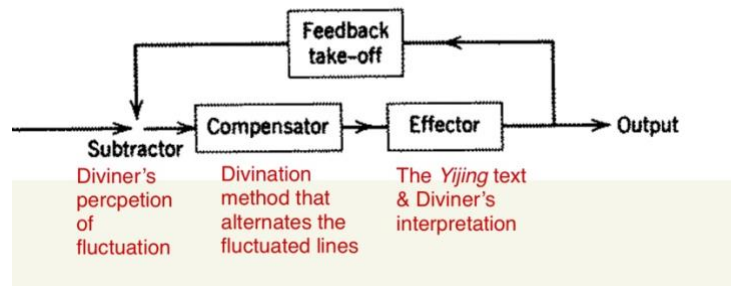


Fig. 8. Diagram of Wiener's general informative feedback and the *Yijing* divination process.

One may immediately notice that the *Yijing* divination seems to be a one-time act, since its output (divination results/suggestions) does not feed back into the practice of divination. A simple answer would be that each divination practice has already gone through many micro-level feedbacks that exchange information between the *Yijing*, the diviner, and their embodied environment, as I briefly listed above. A less obvious answer would be that the divination results do feed back into the practice of divination, providing the diviner with practical examples to continually refine her divination method and cultivate her understanding of the *Yijing* system. However, I want to emphasize that the purpose of this information feedback is not simply pragmatic, such as, in providing more precise and specific divinations. In the *Yijing* tradition, especially the Confucian interpretation of the *Yijing*, the essential function of the *Yijing* divination is to provide moral guidance for self-cultivation that enables “everyone from kings and dukes to the common people” to recognize and harmonize one's act with the Way of the universe, that is, *sheng sheng* (production and reproduction or “life and growth”), as expressed

by the central line of *Xicizhuan*, “Life and growth are the meaning of change [生生之谓易]” (*Xici*, A5.6; Adler, 2019, 270). The Neo-Confucian school (the dominated Chinese official philosophical school from the 13th through the 19th century) develops a whole system of moral philosophy based on the principle of *sheng sheng*, which, to put in a highly reductive way, teaches one to align one’s act with the flow of production and reproduction, rather than obstructing (偏滞) it due to one’s “selfish interest” (私心).

It is worth noting that aligning one’s act with the principle of *sheng sheng* is not meant to be a fatalistic teaching that calls one to blindly follow a predetermined auspicious or ominous outcome. First, the outcomes of *Yijing* divination are always ambiguous and figurative, which can lead to either detailed or general interpretations of tendencies or changes, but not to a prediction of a specific destiny as in Greek mythology. Moreover, as *Xicizhuan* states, “The *Yi* discloses things and completes efforts [开物成务],” which, according to Zhu Xi, “means enabling people to use divination to understand what is auspicious and ominous, and so **to accomplish their affairs** [知吉凶，而成事业]” (*Xici*, A11.1; Adler, 2019, 280). In other words, the *Yijing* divination provides instrumental information for people to better understand their situation and accomplish their work, that is, to carry out their own production and reproduction. On the other hand, one should not “obstruct” the principle of *sheng sheng* by becoming too attached (执) to the ideal outcome that one believes can best satisfies one’s interests or desires. Even the Sages, as *Xicizhuan* states, “suffered good fortune and bad fortune in common with [ordinary] people” (*Xici*, A11.2; Adler, 2019, 280). Therefore, the *Yijing* divination does not and cannot provide a pre-determined vision of the unknown future, but it can transform one’s fear of unknowability and chaos into a moral understanding of endless change and growth, thus encouraging positive acts of creation in alignment with the changes of the universe.

Thus, what the *Yijing* divination practice feeds back into is a universal act of self-cultivation that is morally and practically consistent with the the principle of *sheng sheng*. The feedback of the *Yijing* is different from the feedback of Wiener’s organism-like automata, for the former does not arrive at a specific, statistically programmable *telos* but aims for a universal act of production and reproduction. However, neither is it equivalent to Kant’s “reflective judgement,” which, according to Hui, represents a universal cybernetic mechanism (Hui, 2021, 5), in that it illustrates how organism derives its own rules in the process of moving towards a universal *finality* that is not given in advance as an objective fact and standard, for example, Life or Beauty. Admittedly, like Kant’s reflective judgment, the self-cultivation from the *Yijing* does not presuppose objective rules or standards, but it is still governed by a more or less concrete moral credo, which makes it possible to judge relatively good and bad behavior on a case-by-case basis. In other words, unlike Kant’s reflective judgment, the self-cultivation of *sheng sheng* is neither disinterested nor lacking in a prior concept. Moreover, although Kant does not specify the regulative idea behind the existence of organism, he favors a monotheistic view of creation that attributes the universal *finality* of living things to the design and intent of a transcendent deity,²⁰ which is also the view adopted by Leibniz in justifying the harmony between each organic, self-regulating monad. In contrast, the monotheist creation hypothesis is out of step with the *Yijing*; the principle of *sheng sheng*, or the Way of *Yi*, is acknowledged based on the Sage’s empirical observation of the periodic changes and mutual transformations of nature, i.e., the “alternation of *yin* and *yang*” (一阴一阳).

²⁰ See Kant’s *Critique of Judgement*, section 72. C.f. B. Ziporyn, “Zhu Xi on the Consciousness and Unconsciousness of the Mind of Heaven and Earth: Cross-Cultural Considerations of Ontological Theism and Atheism in Honor of the Work of Professor Donald Munro,” (unpublished manuscript), 7.

Perhaps, a closer view to the *Yijing*'s *sheng sheng* is Bergson's vitalism, if we put aside for a moment the huge gap between the monotheistic and non-theistic traditions. As Bergson argues in his last book, *The Two Sources of Morality and Religion* (1932), human society, which "expresses the sum total of its vitality" through a collectivity of free beings, is also regulated by "a sense of obligation" (Bergson, 1932, 11-12). One source for understanding such obligation is "the inflexible order of the phenomena of life," that is, the force of bodily needs that concerns only "me" or "my" society (Bergson, 1932, 13-15). This "inflexible order of life" often leads to a mechanical and rational approach to morality, for example, Kant's categorical imperative, which theorizes moral obligation as a "resistance to resistances" (Bergson, 1932, 22) in which individual desires are deemed illicit. However, this sense of obligation can also come from another source, that is, a mystical "impetus of love" (Bergson, 1932, 96), which demonstrates a concern for intersubjective connection, creativity, and progression. This mythical experience of love contains moral energy that expresses the creative force of life, which serves as the vitalist foundation of a rigid, mechanical approach to morality, as Bergson claims, "the origins of the process of mechanization are indeed more mystical than we might imagine" (Bergson, 1932, 310). Therefore, Bergson concludes his book with a call for a reunion of mechanism and mysticism, in order to align moral obligation with the force of creation:

"Machinery will find its true vocation again, it will render services in proportion to its power, only if mankind, which it has bowed still lower to the earth, can succeed, through it, in standing erect and looking heavenwards." (Bergson, 1932, 310).

Bergson, the modern steersman, steers the ship of Western morality, a ship lost in the darkness, reminding people to put aside for a moment their rigid, bewildering moral map, and "stand erect and look heavenwards" once again, in order to recognize the path of creativity from the mystical starry sky. Perhaps, this modern steersman could find resonance from those ancient

Sages of the East, who combine maps with the practices of stargazing, providing guidance for the ongoing voyage through the endless ocean of *sheng sheng*. In other words, what connects Bergson to the Sages is their shared emphasis on the necessary integration of mechanism and vitalism, rationality and morality, computability and (embodied) comprehensibility. Both Wiener's cybernetics and the *Yijing* divination establish a cosmo-technological system to realize and normalize this integration. However, for Wiener, this integration is achieved based on a "complete defeat" of vitalism, since the organism-like mechanism can be construed based on a new statistical and digital theory, rather than evoking any mystical moral energy.²¹ This is why, as Hui claims, "today, we think that artificial intelligence [the most advanced descendent of cybernetics] becomes more and more powerful, and the question of the world becomes less and less significant, because we living in a digitalized world, a world of *mathesis universalis*" (Hui, 2021, 9, with my emphasis).

It is not difficult to see that the *Yijing* system provides us a more harmonious version of integrating mechanism with vitalism, and its principle of *sheng sheng* serves as a more promising model for Bergson's moral energy, as it internalizes moral obligation in one's act of creation. In this sense, the *Yijing* indeed offers a possible way "in line with Bergson and beyond Bergson" (Hui, 2021, 19). However, how can the view of the *Yijing* brings concrete contributions to today's discussions of the limits of cybernetics and artificial intelligence? Clearly, I am not arguing for exploring a more powerful artificial intelligence that can assimilate the *Yijing* system. Nor do I wish to argue that the *Yijing* system is more advanced than the digital and information cosmology that dominates today. What comparative study first challenges is the premise and

²¹ "Vitalism has won to the extent that even mechanisms correspond to the time-structure of vitalism; but as we have said, this victory is a **complete defeat**, for from every point of view which has the slightest relation to morality or religion, the new mechanics is fully as mechanistic as the old" (Wiener, 1948, 44).

legitimacy of the authoritative terms as “powerful,” “effective,” or “advanced.” In this sense, the comparative study of the *Yijing* and cybernetics at least urges us to rethink what it means to build an “accurate,” “effective,” or “intelligent” system.

However, I do want to suggest some preliminary yet more substantial contributions the *Yijing* could bring to the study of cybernetics, as perhaps already hinted at in their intertwined history. If we bring back the formal analogy between the hexagrams and binary arithmetic, we can see now that their shared structure of binary progression is emphasized in two quite different ways in the development of the *Yijing* divination and cybernetics. Given that the *Yijing* system managed to develop the “double geometric progression” of *yin* and *yang* into a “simple” divination system combined with human empirical and moral understanding and interpretation of the ever-changing universe, is it possible to imagine a more tolerant, human-compatible version of developing Leibniz’s binary system? This may require a way of establishing a systematic connection between the binary system and the continuous nature, just as how the two ancient mythological diagrams, *Hetu* and *Luoshu*, establish a systematic relationship between *yin* and *yang* and the three-dimensional world (Fig.9).²² In fact, the connection between numerical information and the continuous variations of natural materials has long been used to design information machines known as “analogue machines,” such as spring-mass scale or mechanical

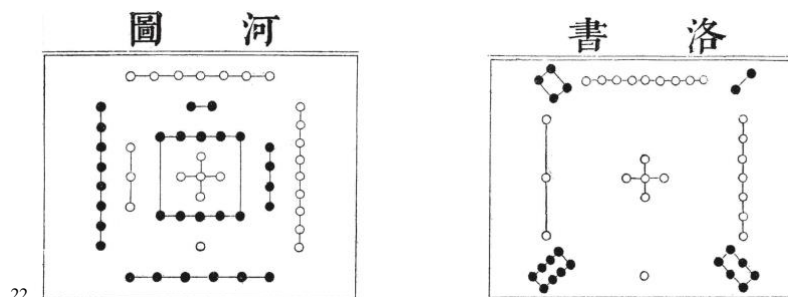


Fig. 9. Diagram of *Hetu* (The River Chart) (left) and *Luoshu* (The Luo Writing) (right)

On how *Hetu* and *Luoshu* indicate the relationship between *yin* and *yang* and natural orientations, see Y. Sun, “The Interpretation of *Hetu* and *Luoshu*,” in *Linguistics and Literature Studies* 8(4): 2020, 190-194.

thermostat. Although Wiener argues that analogue computers are less compatible with highly (mathematically) accurate work than digital computers based on the binary scale, more and more scholars are realizing that digital computers and their discrete elements accounts will inevitably encounter their limitations in dealing with the real, continuous environment, whose “body of real numbers originally known as chaos” (Kittler, 1997, 155). A shift in focus to analogue machine is the foreseeable future if we want to deal with the body of real numbers and real chaos. In fact, the *Yijing* divination already functioned as a “powerful” analogue machine in ancient China, as it provided a systematic approach to the study of the real “noise” and “chaos” of the universe at both the cosmo-technological and socio-ethical levels. Although the power of the *Yijing* system can hardly generate a direct impact on today’s analog machine research (since the universe of the *Yijing* is far removed from our digital and information universe), we can still expect a potential re-union between the two in a future, where the simplicity of mechanism directs towards to a universe that is more mysterious and chaotic, but also more morally intelligible and habitable.

Bibliography:

- Adler, Joseph. *Reconstructing the Confucian Dao: Zhu Xi's Appropriation of Zhou Dunyi*. New York: State University of New York Press. 2014.
- Adler, Joseph & Zhu Xi. *The Original Meaning of the Yijing: Commentary on the Scripture of Change*. Columbia University Press, 2019.
- Bergson, Henri. *Creative Evolution*, trans. Arthur Mitchell. New York: Modern Library, 1944.
- Bergson, Henri. *The Two Sources of Morality and Religion*. Trans. R. Ashley Audra and Cloudesley Brereton, with W. Horsfall Carter. London: Macmillan, 1935.
- Ching, Julia & Oxtoby, Willard G. “Moral Enlightenment, Leibniz and Wolff on China.” *Monumenta Serica*. Monograph Series XXVI. Steyler Verlag: Nettetal. 1992.
- Cook, Daniel J., & Berkowitz, Alan, trans. *Correspondance Leibniz-Bouvet* (CB). <http://leibniz-bouvet.swarthmore.edu/>
- Deleuze, Gilles. *Bergsonism*. Trans. Hugh Tomlinson and Barbara Habberjam. New York: Zone Books, 1991.
- Dreyfus, Hubert. *What Computers Can't Do: A Critique of Artificial Reason*. New York: Harper

- & Row, 1972.
- Hui, Yuk. "Machine and Ecology," *Angelaki* 25(4) (2020): 54–66.
- Hui, Yuk. "On the Limit of Artificial Intelligence." *Philosophy Today* (April 20), 2021.
- Hui, Yuk. *Recursivity and Contingency*. London: Rowman and Littlefield, 2019.
- Hui, Yuk. *The Question Concerning Technology in China: An Essay in Cosmotechnics*. Falmouth: Urbanomic, 2016.
- James, A. Ryan. *Leibniz's Binary System and Shao Yong's "Yijing."* *Philosophy East and West*, Jan., 1996, Vol. 46, No. 1 (Jan., 1996), pp. 59-90.
- Kittler, Friedrich A., and John Johnston. *Literature, Media, Information Systems: Essays*. Amsterdam: GB Arts International, 1997.
- Leibniz, Gottfried Wilhelm. *Die mathematische schriften von Gottfried Wilhelm Leibniz*, vol. 7 (GM VII). Ed. C. I. Gerhardt. Berlin, 1879.
- Leibniz, Gottfried Wilhelm. *Lettres et opuscules inédits de Leibniz précédées d'une introduction*. Ed. Foucher de Careil. Paris, 1854.
- Liu, Yiming & Fabrizio Pregadio, ed. *Cultivating the Tao: Taoism and Internal Alchemy: The Xiuzhen houbian (ca. 1798)*. Mountain View, CA: Golden Elixir Press. 2013.
- Maitre, Marie-Julie. "The Development of Binary Arithmetic by Leibniz: Influence or Independence regarding the *Xiantiantu* of Shao Yong." *Journal of East-West Thought June*. Pomona: California State Polytechnic University (2022): 17-37.
- Nelson, Eric S. "The Yijing and philosophy: From Leibniz to Derrida." *Journal of Chinese Philosophy*. (2011): 377 - 396.
- Perkins, Franklin. *Leibniz and China: A Commerce of Light*. Cambridge ; New York: Cambridge University Press, 2004.
- Ryan, James A. "Leibniz Binary System and Shao Yong's Yijing." *Philosophy East and West* Vol.46, no. 1 (Jan., 1996): 59-90.
- Redmond, Geoffrey. *The I Ching (Book of Changes): A Critical Translation of the Ancient Text*. London ; New York, NY: Bloomsbury Academic, an imprint of Bloomsbury Publishing Plc, 2017.
- Shao, Yong & Chen Yang, ed. *Meihua yishu 梅花易数*. Jiuzhou Press. Beijing: 2019.
- Shao, Yong. *Huangji jingshi shu (HJJS) 皇极经世书*. Ed. *Sibu beiyao*.
<https://ctext.org/library.pl?if=gb&res=570&remap=gb>
- Sun, Yanzhe. "The Interpretation of Hetu and Luoshu." *Linguistics and Literature Studies* 8(4), (2020): 190-194.
- Wiener, Norbert. *Cybernetics, Or Control and Communication in the Animal and the Machine*. Cambridge, MA: MIT Press, 1985.
- Wiener, Norbert. *The Human Use of Human Beings: Cybernetics and Society*. Boston: Houghton Mifflin, 1950.
- Zhang, Peter. "McLuhan and I Ching: An Interological Inquiry." *Canadian Journal of Communication* 39, no. 3 (2014): 449–68.
- Zhu, Xi. *Zhouyi benyi 周易本义*. Ed. Qianlong yulan siku quanshu huiyao.
<https://ctext.org/library.pl?if=gb&res=91567&remap=gb>
- Ziporyn, Brook. "Zhu Xi on the Consciousness and Unconsciousness of the Mind of Heaven and Earth: Cross-Cultural Considerations of Ontological Theism and Atheism in Honor of the Work of Professor Donald Munro." Unpublished Manuscript.