

Chu Hsi on Nature and Science

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Abstract

If we look, in Chu Hsi, for something that would appear “scientific” to us, we come up with the following three kinds. 1) First, most widespread were the isolated bits of natural knowledge in his numerous writings and conversations. 2) And then we must look at what we might call “natural philosophy”: his discussions on *li* 理, *ch'i* 氣, yin-yang 陰陽, the five phases, etc. 3) Finally, and most conspicuously, he had numerous discussions of various branches of specialized knowledge, such as astronomy, harmonics, music, geography, “images and numbers” (*hsiang-shu* 象數), and so on. As a sum, these various kinds of Chu Hsi’s natural knowledge showed an impressive breadth, and sometimes even depth. Yet, they did not form a single coherent whole for Chu Hsi. Instead, each of them was a part of a larger genre, none of which was confined to natural realm. This shows that for Chu Hsi “science” was not a separate, independent category. For Chu Hsi, there were no clearly delineated terms which would stand for “science” and “nature,” and which were distinguishable from what is “non-science” and “non-nature.” Nor did “science” and “nature,”

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for him, neatly correspond to each other. “Science,” even if we could find something in him that we could call by that name, was not a field devoted exclusively to the study of the natural world; the natural world was not something to be studied only “scientifically.”

In this paper, recognizing all this, I look at the above various genres of Chu Hsi’s knowledge about the natural world, and discuss some key features of them. I begin, in Section 2, by outlining Chu Hsi’s notion of the natural world and his characteristic attitude toward natural phenomena, viewing the objects and phenomena of the natural world as “natural” — as obvious and matter-of-fact. Section 3 then shows how this attitude can be related to some key aspects of the basic ideas and assumptions of Chu Hsi’s natural philosophy, and suggests how some general features of the conceptual schemes he used in discussing things and events of the natural world might have conditioned his perception and understanding of the natural world. Section 4 follows with the discussion of Chu Hsi’s attitude to specialized scientific branches. Finally, Section 5 concludes with some speculations about the possible effect of Chu Hsi — his natural knowledge and attitude to nature and science — in the subsequent development of science in China.

1. Introduction: Chu Hsi’s Knowledge about the Natural World

If we look, in Chu Hsi 朱熹 (1130-1200), for something that would appear as “science” or “scientific” to us, we come up with the following three kinds. 1) First, most widespread were the isolated bits of natural knowledge in his numerous writings and conversations. 2) And then we must look at what we might call “natural philosophy”: his discussions on *li* 理, *ch’i* 氣, yin-yang 陰陽, the five phases (*wu-hsing* 五行), etc. 3) Finally, and most conspicuously, he had numerous discussions of various branches of specialized knowledge, such as astronomy (*t’ien-wen li-fa* 天文曆法), harmonics (*lü* 律), music (*yueh* 樂), geography

(*ti-li* 地理), “images and numbers” (*hsiang-shu* 象數), and so on. As a sum, these various kinds of Chu Hsi’s natural knowledge showed an impressive breadth, and sometimes even depth. Yet, they did not form a single coherent whole for Chu Hsi. Indeed, there was no general notion, comparable to our notion of “science,” that covered all the above. Instead, each of them was a part of a larger genre, none of which was confined to natural realm.¹

Thus, the first of the above three kinds, numerous pieces of natural knowledge that came up in his various writings and records of conversations, the main focus of which was on the moral and social issues, by no means centered on the natural world. Frequently, they came up when he commented upon certain natural phenomena referred to in the classics supposedly written by — or at least contained the intentions of — the sages (*sheng-jen* 聖人). In such cases, natural objects and phenomena were discussed by Chu Hsi in some detail, and his interest in them appeared quite strong. But his actual concern was with elucidating the sages’ intentions. Similarly, Chu Hsi’s discussion of the second kind never formed a separate genre that can be called “natural philosophy”; it was part of philosophy in general. The last kind of Chu Hsi’s natural knowledge, on the other hand, can be seen as part of a broad genre of specialized knowledge that also in-

1 Much of the content of this paper is based upon my findings discussed in more detail in my book, *The Natural Philosophy of Chu Hsi* (1130-1200) (Philadelphia: American Philosophical Society, 2000). The following abbreviations are used in citing the Chu Hsi sources.

WC: *Hui-an-hsien-sheng Chu-wen-kung wen-chi* 晦庵先生朱文公文集 (*Ssu-pu pei-yao* 四部備要 edn.)...*WC*60.17a refers to the 60th *chüan* 卷, p. 17a.

YL: *Chu-tzu yü-lei* (朱子語類 1270 edition, reprinted in 1473, modern reprint by Cheng-chung shu-chü 正中書局, Taipei)...*YL*49.2a3 refers to the 49th *chüan*, the 3rd passage beginning on p. 2a. *YL*15.9b0 refers to the 15th *chüan*, the passage that begins in the previous page (p. 9a) and is continued on p. 9b. The following approximate formula can be used to convert the page in the 1473 edition (p) into the page in the modern punctuated edition (Chung-hua shu-chü 中華書局, Beijing, 1986) (q):

$$q = (q^0 - 1) + 1.2p,$$

where “q⁰” is the first page of the relevant *chüan* in the Chung-hua shu-chü edition.

cluded laws, criminal justice, taxation, military affairs, official duties, etc. Of course, each of the above branches of astronomy, harmonics, geography, etc. was itself a separate, independent area, with its own specialist tradition. But when these areas of specialized knowledge were mentioned together, there was never any clear distinction between what belong to the natural realm and what do not.

This shows that for Chu Hsi “science” was not a separate, independent category. The above sort of separate pieces of knowledge constituted parts of the great philosophical system of Chu Hsi, referred to as “Neo-Confucian synthesis,” which included everything. One has the feeling that the scientific knowledge became part of his system as the system came to include everything. Thus, for Chu Hsi, there were no clearly delineated terms which would stand for “science” and “nature,” and which were distinguishable from what is “non-science” and “non-nature.” Furthermore, “science” and “nature,” for him, did not neatly correspond to each other. “Science,” even if we could find something in him that we could call by that name, was not a field devoted exclusively to the study of the natural world. And the natural world was not something to be studied only “scientifically.”

In this paper, recognizing all this, I look at the above various genres of Chu Hsi’s knowledge about the natural world, and discuss some key features of them. I begin, in Section 2, by outlining Chu Hsi’s notion of the natural world and his characteristic attitude toward natural phenomena, viewing the objects and phenomena of the natural world as “natural” — as obvious and matter-of-fact. Section 3 then shows how this attitude can be related to some key aspects of the basic ideas and assumptions of Chu Hsi’s natural philosophy, and suggests how some general features of the conceptual schemes he used in discussing things and events of the natural world might have conditioned his perception and understanding of the natural world. Section 4 follows with the discussion of Chu Hsi’s attitude to specialized scientific branches. Finally, Section 5 concludes with some speculations about the possible effect of Chu Hsi — his natural knowledge and attitude to nature and science — in the subsequent development of science in China.

2. Nature as “Natural”: The Natural World of Chu Hsi

For Chu Hsi, the world consisted of the three basic constituents: heaven and earth (*t'ien-ti* 天地), the myriad things (*wan-wu* 萬物), and man (*jen* 人). These three stood in various relations to one another.

To begin with, heaven (or heaven and earth) produces men and the myriad things. Thus produced by heaven and earth, men and things live — or exist — between heaven and earth. They receive the *ch'i* and the mind of heaven and earth and have them as their *ch'i* and minds. Of all that are produced by heaven and earth, man is most numinous, for he is endowed with the *ch'i* that is most correct, clear, complete, and so on. Man, therefore, forms a triad with heaven and earth, and complements the activities of heaven and earth. Chu Hsi also spoke of many aspects in which men and things, especially men, are parallel to heaven and earth. Sometimes the parallelism changed into an identity, giving rise to the notion that man is one with the whole world of heaven and earth and with everything in it.²

The world made of these three constituents covered everything, not merely the things that can be characterized as “physical” or “material.” For Chu Hsi, no boundary existed which separated what are “natural” from what are not. Objects and phenomena involving life and mind, and even morality, were included in his world of heaven and earth, the myriad things, and man; there was no clear distinction between “natural” and “non-natural” realms in that world. This lack of distinction was evident also in such basic concepts as *ch'i*, yin-yang, and the five phases, which were endowed with characteristics of life, mind, and morality, as well as matter.

One consequence of this was that, for Chu Hsi, the “natural” world existed in harmony with the “non-natural” — human and social — world. There could be no possibility of tension between the morally neutral “natural” world and the hu-

² Kim, *Natural Philosophy of Chu Hsi*, Chap. 7.

man world that is governed by morality. On the contrary, and in part owing to the above-mentioned idea of parallelism, and even identity, between man and heaven and earth, the “natural” world, referred to as “heaven and earth,” was frequently invested with moral qualities. This, then, is what lay at the basis of the idea of “cosmic basis of morality,” the notion that a moral order underlies the natural world providing a kind of basis for morality.³

In sum, Chu Hsi’s “natural” world was an integral part of the larger world that also contained human and social realms, with no boundary between them. Nothing was excluded from this world of Chu Hsi.

This natural world — what exists in it, what happens in it — was “natural” for Chu Hsi. Most of the objects and phenomena in the natural world were, to him, obvious. He took them for granted, in a “matter-of-fact” manner, and did not feel any need to explain them. In fact, they were so “natural” and obvious to Chu Hsi that he frequently alluded to some common and familiar natural phenomena in the course of discussing moral and social problems, by adducing analogies between the obvious natural phenomena and the latter problems that were considered more problematic. Only rarely did he mention such common natural phenomena for themselves.

For example, Chu Hsi spoke of the fact that once a cart has started to move, no great exertion of force is needed to keep it moving; he argued that, in study also, a great exertion of effort is needed only at the beginning, after which it becomes easy.⁴ Similarly, to explain that when impurities enter the mind it loses “sincerity” (*ch’eng* 誠) and falls into self-deception, he used the analogy that

3 E.g., Thomas A. Metzger, *Escape from Predicament: Neo-Confucianism and China’s Evolving Political Culture* (New York: Columbia University Press, 1977), Secs. 3i and 3p; Peter K. Bol, “Chu Hsi’s Redefinition of Literati Learning,” in William Theodore de Bary and John W. Chaffee, eds., *Neo-Confucian Education: The Formative Stage* (Berkeley: University of California Press, 1989), pp. 151-185.

4 E.g., YL31.8a0,1, 8b0,1,2, 9a1, 9b2, 78.35b1.

when gold is mixed with a small amount of silver the whole bulk of gold loses its worth as gold.⁵ On “the method of reading books” (*tu-shu-fa* 讀書法), especially on the need for “careful reading,” two different analogies argued for the same point:

Generally, in reading books, it is necessary to read carefully. When read carefully, the essences [of the books] will spontaneously become familiar; after the essences have become familiar, the *li* will spontaneously be seen. It is like eating a piece of fruit. When one first bites it, one does not know the taste; one simply eats it. One has to chew it into tiny and soft pieces, then the taste spontaneously comes out, and one begins to know whether this is sweet or bitter. ... [It is also like] a gardener watering gardens. One who is good at watering waters each tree, following its vegetables and fruits. After a while the watering becomes sufficient, then water and soil are mixed and the things [i.e. vegetables, fruits and trees] get nourishment and grow naturally. One who is not good at watering administers it hurriedly. ...⁶

It is not impossible to learn from these examples something about Chu Hsi’s views on natural phenomena — tendency of moving objects, properties of mixture of metals, perception of tastes, and nourishment of plants. But his real concern lay elsewhere — to argue for strong exertion of effort at the beginning stage of study, for the importance of sincerity and purity of the mind, and for the necessity of careful reading, by showing that these points were analogous to the natural phenomena. In none of the examples were the phenomena themselves what Chu Hsi was really interested in.

Many concrete natural phenomena and objects came up in this context in Chu Hsi’s discussions. Thus, his frequent references to effects of medicines and to clarity of water were usually intended for discussions, by way of analogy, of

5 E.g., *YL*16.19b0, 59.36a2.

6 *YL*10.6a1. See also *YL*80.19b1.

human nature (*hsing* 性) and the state of mind (*hsin* 心). He resorted to the fixed sequence of the seasons to make the point that the constant human virtues cannot be changed. Even the retrograde motion of planets came up in a similar context, i.e. to illustrate that man's mind, normally compassionate, can sometimes become cruel.⁷ He went as far as inventing natural phenomena to support his points concerning analogous human problems. For example, he said that a tree will die if it stops growing for a single day, in order to back up his point that one should keep studying every day.⁸

The most famous example of Chu Hsi's discussion of natural phenomena came up in a similar context. L. Carrington Goodrich in 1942 drew attention to Chu Hsi's following comment on the shells on mountains, and considered this as showing the latter's understanding of the nature of fossils.⁹

I have seen on high mountains shells of conches and oysters, some of them in the rocks. These rocks were soils in earlier days, and the conches and oysters are the things [living] inside water. [What happened is that] what was low has changed and become high, and what was soft has changed and become hard... (常見高山有螺蚌殼, 或生石中. 此石即舊日之土, 螺蚌即水中之物. 下者卻變而為高, 柔者變而為剛. . . .)¹⁰

This passage, and similar passages of Shen Kua 沈括 (1031-1095),¹¹ led to some

7 YL57.12a1.

8 E.g., YL72.24a2,3. For more on this and other examples, see Kim, *Natural Philosophy of Chu Hsi*, Chap. 10. John E. Murdoch has mentioned instances in medieval Europe in which certain theological points appear to have been used as excuses to discuss such natural phenomena as light, motion and celestial spheres, cases which appear to be exactly opposite to what Chu Hsi did: Murdoch, "From Social into Intellectual Factors: An Aspect of the Unitary Character of Late Medieval Learning," in John E. Murdoch and Edith D. Sylla, eds., *The Cultural Context of Medieval Learning* (Boston: Riedel, 1975), pp. 271-339, esp. pp. 278-279.

9 L. Carrington Goodrich, "Early Mentions of Fossil Fishes," *Isis* 34 (1942), 25.

10 YL94.3.

11 Shen Kua, *Meng-hsi pi-t'an* 夢溪筆談 (reprinted in 1975, Beijing: Wen-wu ch'u-pan-she 文物

very enthusiastic evaluations — or over-evaluations — of Chu Hsi's, and Shen Kua's, understanding of the nature of fossils, which was achieved, as it was often noted, centuries before the West. The explanation was that in the absence of the obstacles like the belief in the creation of the world several thousand years past, which precluded the correct understanding of the nature of the fossils in the West, these Sung Chinese thinkers could see the implications of such common observations, and recognized "that some of the life-like forms discovered in the rocks were in fact remains of ancient animals."¹²

It should be noted, however, that the assertion in the above quotation was made while Chu Hsi was discussing and illustrating the cosmogony of *Huai-nan-tzu* 淮南子 and the theory of the yin-yang cyclical repetition, which together formed the basis of his own cosmology.¹³ Change of sea water into mountains was mentioned by Chu Hsi as a detail of the *Huai-nan-tzu* cosmogony, according to which the primordial *ch'i* in the beginning of the world rotated, and the sediments of the *ch'i* were precipitated at the center to form the earth. But as the last sentence in the quotation indicates, Chu Hsi was also using the change to illustrate the cyclical alternation of the yin and yang characteristics: what is low (the bottom of the sea) becoming high (mountain); what is soft (mud) becoming hard (stone). Thus clearly, what he was discussing was not a paleontological theory or the nature of fossils, but simply an illustration of the yin-yang scheme and a traditional cosmogony.¹⁴

出版社), chap. 21, nos. 373, 374.

12 Joseph Needham, *Science and Civilisation in China* (Cambridge: Cambridge University Press, 1954-), vol. 3, p. 611.

13 *Huai-nan-tzu* (*Ssu-pu pei-yao* 四部備要 edn.), 3.1a. For more on this, see Kim, *Natural Philosophy of Chu Hsi*, Sec. 9.1.

14 It might be added in passing that a similar idea is found in the pre-Socratic philosopher Xenophanes (6th century B.C.), who, according to Hippolytus (3rd century A.D.),
..... thinks that a mixture of the earth with the sea is going on, and that in time the earth is dissolved by the moist. He says that he has demonstrations of the following kind: shells are found inland, and in the mountains, and in the quarries in Syracuse he says that an impression

3. Basic Ideas and Conceptual Schemes

One can see some key aspects of Chu Hsi's basic ideas and assumptions that made him consider natural phenomena to be so "natural"— obvious, matter-of-fact.

For instance, qualities and activities of *ch'i* were considered innate, and thus once certain phenomena had been attributed to certain qualities and activities of *ch'i*, they were deemed sufficiently accounted for — without any need to look for external causes or hidden mechanisms.¹⁵ Chu Hsi's account of the formation of the earth, for example, will illustrate the point.

In the beginning of heaven and earth there was only the *ch'i* of yin and yang. This *ch'i* moved and turned around continuously. When the turning became very rapid, a large quantity of the sediments of *ch'i* was compressed. And as there was no outlet [for the sediments] these consolidated to form the earth in the center.¹⁶

He referred to rapid rotation of *ch'i* as what is responsible for the formation of the earth, but he never paid attention to the cause of such rotation. It was almost as if rotation were the natural activity for *ch'i*.

Chu Hsi's concept *li* also had an effect. *Li* of an object or phenomenon, to him, was merely something because of which the object exists or the phenomenon takes place as it actually does: when and only when there is *li* for it, does it

of a fish and of seaweed has been found, while an impression of a bay-leaf was found in Paros in the depth of the rock, and in Malta flat shapes of all marine objects. These, he says, were produced when everything was long ago covered with mud, and the impression was dried in the mud. All mankind is destroyed whenever the earth is carried down into the sea and becomes mud; then there is another beginning of coming-to-be, and this foundation happens for all the worlds. [See G. S. Kirk and J. E. Raven, eds., *The Presocratic Philosophers* (Cambridge University Press, 1957), p. 177.]

15 For more detailed discussion, see Kim, *Natural Philosophy of Chu Hsi*, Chap. 3.

16 YL1.4b3.

exist or take place. Thus, *li* was not conceptually simpler or more fundamental than the object or phenomenon itself. *Li* referred to a given object or phenomenon as a whole in its totality; it was not what can be used in the explanation or analysis of the object or phenomenon in simpler terms. When *li* was mentioned, it was merely invoked to assure the existence or occurrence of the object or phenomenon. Nor was the content of *li* analyzed; it is grasped as a whole. Thus, when Chu Hsi noted regularities in nature, he was concerned only with their existence, but not with concrete details of those regularities which he sometimes referred to as *li*.¹⁷

The dichotomy of what is “above physical form” (*hsing-er-shang* 形而上) vs. what is “below physical form” (*hsing-er-hsia* 形而下) also facilitated ready acceptance of natural phenomena. Abstract and sublime concepts without manifest “physical forms” (*hsing* 形)— the Way (*tao* 道), *li*, mind and human nature, for example — belong to the former while concrete things with tangible physical forms are the examples of the latter. Naturally, what is without physical form was difficult to understand and was thought to be important and worthy of further consideration, whereas what has physical form and is visible was easy to understand, and was considered obvious and even trivial. Since most common natural phenomena are accompanied by tangible qualities and physical effects and are “below physical form,” they were thought to be obvious and were simply accepted in the way they were perceived; no further investigation was attempted beyond the surface of the phenomenal realities of empirical data.¹⁸

17 Kim, *Natural Philosophy of Chu Hsi*, Chap. 2.

18 Typical was Chu Hsi's comment on the famous dialogue between Ch'eng I 程頤 (1033-1107) and Shao Yung 邵雍 (1011-77) on the question of where thunder comes from: On Ch'eng I's saying, “Thunder comes from where it comes from,” which had been given in response to Shao Yung's question, “Where do you think [thunder] comes from?”, Chu Hsi's comment was: “Why must one know where it comes from?” (YL100.11a0) The dialogue is recorded in *Honan Ch'eng-shih i-shu* 河南程氏遺書 (Surviving Works of the Ch'engs of Honan) chap. 21a: *Erh-Ch'eng-chi* 二程集 (modern punctuated edn., Beijing: Chung-hua shu-chü 中華書局, 1981), p. 270.

The perennial Confucian emphasis on the reality of the external world also seems to have reinforced the readiness in accepting commonly-observed natural phenomena. Confucians considered their acceptance of the reality of the world to be what distinguished them from Taoists and Buddhists.¹⁹ They were not actively engaged in concepts like “void” (*k'ung* 空, *hsü* 虛) and “nothingness” (*wu* 無), which were too easily associated with Taoists and Buddhists who tended to lead men to concentrate on introspection without paying attention to the actual world. This made Confucians like Chu Hsi to simply accept natural phenomena rather than to engage themselves in abstract, theoretical discussions about them.²⁰

The conceptual schemes — yin-yang, the five phases, etc. — Chu Hsi used in discussing things and events of the natural world conditioned his perception and understanding of them in other ways as well. For example, reflecting the lack of distinction between “natural” and “non-natural” realms, the concepts of *ch'i*, yin-yang, the five phases, and so on, were endowed with characteristics of life, mind, and morality as well as matter, and covered everything in the world, not confined to what we would call “natural” world.²¹

Most of these basic concepts form sets of categories. As categories, they are associated with various sets of characteristics. Different characteristics associated with a given category are connected to one another, thus giving rise to a network of mutual associations. In fact, this kind of association was a key mode of explanation in Chu Hsi's discussion of natural phenomena, and indeed, such categorical and associative character was a universal feature of the traditional Chinese discourse about the natural world, which many commentators have noted and re-

19 Chu Hsi said, for example: “The difference between Confucians' and Buddhists' sayings about [human] nature is simply that Buddhists speak of the void [whereas] Confucians speak of reality, and that Buddhists speak of nothingness [whereas] Confucians speak of existence.” YL126.7b2.

20 Kim, *Natural Philosophy of Chu Hsi*, Sec. 13.5.

21 Kim, *Natural Philosophy of Chu Hsi*, Chaps. 3-5.

ferred to variously as “correlative thinking” and “the system of correspondence.”²²

We can see many examples showing this character of Chu Hsi’s thought. For one, the four seasons and the four cosmic qualities — *yuan* 元, *heng* 亨, *li* 利, and *chen* 貞 — formed a network of four-fold sets of mutually associated characteristics, through their respective five-phase associations with weather, compass directions, and the constant human virtues. They were further associated with four of the seven sentiments (*ch’i-ch’ing* 七情) — love, joy, hatred and desire — and with various other four-fold sets of human characteristics. He could even include four parts of a day — day, night, dusk and dawn — and the four legs of a fire stove.²³ Some sets of characteristics were associated directly with each other, without bringing in, as intermediaries, associations with the basic categories like yin-yang and the five phases. Thus, the five musical notes (*wu-sheng* 五聲) were directly associated with a group of five different things: the *kung* 宮 note with rulers, *shang* 商 with ministers, *chiao* 角 with people, *chih* 徵 with events, and *wu* 羽 with things.²⁴ The twelve musical pitches (*shih-er-lü* 十二律) were associated with the twelve months.²⁵ Chu Hsi also mentioned associations of man’s perceptual organs with visceral organs, eyes with liver and ears with kidneys for example.²⁶

These associations appear quite arbitrary to us. At times Chu Hsi himself seem to have felt a need to explain some of those associations; but more often, he simply stated the associations without any explanation.²⁷ All he did for cer-

22 E.g., Needham, *Science and Civilisation*, vol. 2; Manfred Porkert, *The Theoretical Foundations of Chinese Medicine: Systems of Correspondence* (Cambridge, MA: MIT Press, 1974); John B. Henderson, *The Development and Decline of Chinese Cosmology* (New York: Columbia University Press, 1984); A. C. Graham, *Yin-Yang and the Nature of Correlative Thinking* (Singapore: The Institute of East Asian Philosophies, 1986).

23 For these and other sets of five-phase associations, see Kim, *Natural Philosophy of Chu Hsi*, Chap. 4. On the four cosmic qualities, see Kim, *Natural Philosophy of Chu Hsi*, Sec. 5.4.

24 E.g., YL78.36b0, 92.10b0.

25 E.g., YL87.11b2.

26 E.g., YL53.10a1.

27 Kim, *Natural Philosophy of Chu Hsi*, Sec. 4.4.

tain sets of terms was to associate them with a known set of categories as though such association constituted a sufficient explanation. For example, he explained the cryptic passage of the *Hsün-tzu*, “Clear brightness has inner shadow and turbid brightness has outside shadow,” merely by associating the former with metal and water and the latter with fire and the sun.²⁸ At times he merely mentioned a few distinguishing characteristics for certain sets of related terms without actually discussing them, not even associating them with known categories. His discussion of different kinds of changes is a good example, because all he did in numerous passages dealing with them was to distinguish the sudden change, “*pien*” 變 or “*shen*” 神, from the gradual one, “*hua*” 化.²⁹

These categorical and associative basic concepts are also cyclical: they come in cycles that repeat fixed sequences. Not only the concepts like yin-yang and the five phases, but characteristics associated with them also show cyclical character.³⁰ Various yin-yang characteristics follow each other continuously, forming cycles that have no beginning or end: movement and rest, contracting and expanding, vanishing and growing, going and coming, opening and closing, day and night, life and death, hot and cold weather, and so on. Many sets of five-phase characteristics, the four seasons, the four cosmic qualities, the life-cycle of plants, for example, also repeat their fixed sequences endlessly. Chu Hsi even said that regret, good luck, parsimony, and bad luck, which are associated with the four seasons, “circulate like spring, summer, autumn and winter.”³¹ Thus, for him, such endless cyclical repetition was a universal feature of natural phenomena, which is not surprising because the cyclical nature of many natural phenomena — movement of the luminaries in the sky, change of the seasons, the tides, the plant life-cycles, and even bending and stretching movements of the

28 YL1.8b4. The original passage is from the “Chieh-pi” 解蔽 chapter of the *Hsün-tzu* 荀子.

29 Kim, *Natural Philosophy of Chu Hsi*, Sec. 8.3.

30 Kim, *Natural Philosophy of Chu Hsi*, Secs. 4.2, 4.2,

31 YL74.9b0.

measuring worm — must have been obvious even to a most casual observer. In fact, the cyclical repetition became another key feature of traditional Chinese perceptions of natural phenomena.³²

4. Chu Hsi's Attitude toward Specialized Subjects

Chu Hsi had a strong interest in various branches of specialized knowledge involving natural phenomena, such as calendrical astronomy, harmonics, geography, and medicine, and in some of them his understanding reached a fairly high level of sophistication. His interest in these technical subjects became very strong late in his life. Much of his discussion on calendrical astronomy and other scientific subjects took place in the late 1190s, when he and his school suffered a vicious political persecution. In the last few years before his death, he spent a great effort in trying to master the content of the *Ts'an-t'ung-ch'i* 參同契, a classic of inner alchemy.

Chu Hsi's attitude toward the specialized knowledge was different for different branches. The subjects that Chu Hsi discussed most frequently were calendrical astronomy (*li* 曆), harmonics (*lü* 律) and geography (*ti-li* 地理). These subjects, for him, were clearly part of the Confucian tradition. Toward the practices connected with these subjects, such as astrology (*t'ien-wen* 天文 or *chan-hsing* 占星), music (*yüeh* 樂) and geomancy (*feng-shui* 風水, literally, “winds and waters”), on the other hand, his attitude varied. He discussed music frequently, but on astrology and geomancy he did not have much to say. It must have been that he did not fully accept the latter activities, whereas music, a part of the Confucian rituals (*li* 禮), was important for him.

Another subject discussed frequently by Chu Hsi was the so-called “images and numbers” (*hsiang-shu* 象數). Consisting mainly of numerological specula-

32 It is in reference to such cyclical repetition that Needham has characterized “Chinese physics” by the concept of “wave” as opposed to “particle”: e.g., *Science and Civilisation*, vol. 4, part I, pp. 3-14.

tions involving simple numbers and the *I-ching* 易經 diagrams, it was based essentially on the *I-ching* texts and commentaries; Chu Hsi referred to it as “the study of the *i*” (*i-hsueh* 易學) also. He considered the subject to be fully worth paying attention of Confucian scholars, though various post-Han influences, including much that could be called “Taoist,” had infiltrated it. The study of “images and numbers” was also applied to other practices, such as divination (*chan* 占 or *pu* 卜) and alchemy (*tan* 丹 or *lien-tan* 煉丹). Chu Hsi did not refrain from discussing either of these activities; indeed, he wrote quite extensively about various aspects of both practices. Then, there were various other techniques linked with these practices, whose experts were called “the masters of the Way” (*tao-shih* 道士). Chu Hsi had less to say, however, and perhaps rather low opinions, about these subjects, except for the technique of “nourishing life” (*yang-sheng* 養生), the so-called “internal alchemy” (*nei-tan* 內丹), in which he had a considerable interest.

Medicine (*i* 醫), did not command Chu Hsi’s interest quite as much as the above four subjects — calendrical astronomy, harmonics, geography and “the images and numbers.” In his comments on Tzu-Hsia’s 子夏 saying in the *Analects* 論語 — “Even ‘the small ways’ (*hsiao-tao* 小道) must have what are worth ‘looking at’ (*kuan* 觀). But if pursued too far, one may be bogged down. For this reason great men do not ‘do’ (*wei* 為) them.” — Chu Hsi mentioned medicine among his examples of “the small ways,” which included such things as agriculture (*nung* 農), horticulture (*p’u* 圃), divination and techniques (*kung* 工), but not the above four subjects.³³ And for him, medical specialists (*i-chia* 醫家) belonged to the same category as Taoists, Buddhists, diviners, technicians and “the nourishing-life specialists” (*yang-sheng-chia* 養生家). It is understandable, then, that while frequently mentioning various drugs and other remedies, Chu Hsi rarely touched upon the technical content of medical knowledge. Nor did he speak much of the related subject, “materia medica” (*pen-ts’ao* 本草); he did record de-

33 E.g., YL49.2a3. The *Analects* passage comes from chap. 19.4.

scriptions of many plant and animal species, but most of these were in his commentaries on the *Book of Poetry* (*Shih-ching* 詩經) and the *Songs of Ch'u* (*Ch'u-tz'u* 楚辭).

As for the remaining specialized branches of mathematics (*suan* 算, literally, “computation”), agriculture and techniques, Chu Hsi had even less to discuss. But he could not ignore them altogether, for he must have faced problems involving knowledge of these subjects, agriculture in particular, in performing official duties as local administrators.

It has to be noted, however, that, along with these subjects and activities, Chu Hsi also spoke of, and wrote about, many other specialized topics such as protocols for rites and ceremonies, burial methods, military strategies and transportation vehicles, methods of calligraphy and painting, laws and criminal justice, land, tax and finance, civil service administration and other institutions. For him, these latter subjects that take up large portions of his conversations and writings were not different from the above-mentioned ones in that they were also specialized, practical branches of knowledge with their own experts. And then, there were the traditional “six arts” (*liu-i* 六藝), the six basic skills which Chu Hsi considered as essential for education of children (*hsiao-hsüeh* 小學): rites, music, archery, charioteering, calligraphy, and computation.³⁴

Chu Hsi's basic position on these specialized subjects in general was that they should be studied also, and should not be ignored. He said, for example: “As for things like harmonics, calendars, criminal justice, laws, astronomy and geography, armies and official positions, [these] must all be understood.”³⁵ This attitude of Chu Hsi was closely linked with his doctrine of *ke-wu* 格物, which, interpreted to mean “investigating the *li* of things,” tended to emphasize studying all concrete events and things in all areas of human concern.³⁶ He said repeatedly

34 E.g., YL7.1a1, 1b4.

35 YL117.22b0.

36 On Chu Hsi's ideas of the *ke-wu* doctrine, see Kim, *Natural Philosophy of Chu Hsi*, Chap. 2.

that every thing or event in the world has its *li* and should be studied and understood.³⁷ He interpreted certain expressions from the classics, the *Analects* in particular, in this spirit of the *ke-wu* doctrine. For example, he used the emphasis in the *Analects* on “broad study” (*po-hsüeh* 博學) in supporting his insistence upon studying and understanding everything.³⁸ Confucius’s phrase, “study down below and attain up above” (*hsia-hsüeh shang-ta* 下學上達), was used also in the same vein by Chu Hsi, who emphasized that one should start with concrete things that are clearly manifest and easy to understand.³⁹

There were other reasons that Chu Hsi was interested in the specialized branches of knowledge. For instance, many of them were associated with important philosophical terms and concepts. Importance of the concept of “heaven” (*t’ien* 天), for example, made calendrical astronomy, the subject that deals with the physical heaven, important for him. Geography and geomancy, on the other hand, could be seen to be connected with the other half of the term “heaven and earth.” Importance of music as part of Confucian rituals made the related subject of harmonics also important. Similarly, importance of the *I-ching*, and the ideas and diagrams in the classic, could be translated into importance of the subjects of “images and numbers,” and divination and alchemy which used them. Alchemy, especially in the form of “the internal alchemy,” could be related to the concept of “the Way,” because it was among the techniques practiced by those who seek the Way, the so-called “masters of the Way.” Investigating these subjects would clearly help one understand the *li* of the ideas and concepts associated with them.

Moreover, knowledge of some of the subjects was present in the texts widely

37 E.g., *YL*15.4b2, 18.22b0, 34.33b0, 116.13b0, 117.12b0.

38 *YL*117.22b0. The expression “*po-hsüeh*” appears, e.g., in the *Analects*, 12.5, 19.6.

39 E.g., *YL*44.19b0-21b2; *WC*47.13a. See also *YL*117.21a3, where Chu Hsi criticized those who “study down below today and wish to attain up above tomorrow.” The Confucius’s phrase appears in the *Analects*, 14.37.

studied by scholars — the standard commentaries of the classics and the official dynastic histories, in particular. The latter almost always included treatises on astronomy, calendars, harmonics, geography, as well as on rites and music. Chu Hsi studied the relevant portions of these commentaries and treatises, and his understanding of them reached a considerable level. He could make his own judgment as to which of them were best for a particular subject or problem.⁴⁰ There were also treatises on specialized subjects written by scholars themselves.

It should not be ignored that knowledge of some of these subjects was actually needed for performing official duties. To be sure, traditional Chinese civil service did include offices devoted to specialized branches and filled by specialists. But generalist officials like Chu Hsi also could face tasks involving specialized knowledge and, in any case, had to manage and supervise the specialist officials who were usually of lower official status. This need was at least in part the reason why Chu Hsi included the subjects in his proposal for examination, classifying them under the category of “the current tasks” (*shih-wu* 時務).⁴¹

Yet, in spite of his emphasis on the need to study and understand specialized subjects, Chu Hsi did not hide his feelings that there were more important subjects — moral and philosophical problems. In fact, he said repeatedly that one has to understand “the basis” (*pen* 本), or what is “great,” before moving on to “small” matters.⁴² Otherwise,

if one does not understand this basis first and merely desires to take up [particular] events and to understand them, then even if one understands many curiosi-

40 Indeed, this was what he had to do, for, having asserted the importance of the specialized subjects and the necessity to study them, he had to decide which texts were the best or correct ones to be studied, just as he did for the moral and social philosophies. For this aspect of Chu Hsi’s “program of learning” in general, see, e.g., de Bary, “Chu Hsi’s Aims as an Educator”, in de Bary and Chaffee, *Neo-Confucian Education* (*op. cit.*, note 2), pp. 186-218; Daniel K. Gardner, *Chu Hsi: Learning to Be a Sage* (Berkeley: University of California Press, 1990), pp. 35ff.

41 WC69.22a.

42 E.g., YL64.5b1, 84.3b0, 116.13b0.

ties [they will] only add to much confusion and disorder, and only to much overbearing and parsimony.⁴³

It must have been for this reason that, though Chu Hsi studied specialized subjects and attained various levels of knowledge in them, his understanding never reached that of the specialists. He even admitted that it was not necessary to try to reach a complete understanding of all the details of these subjects.⁴⁴ Indeed, people with adequate knowledge of these subjects were rare. On Chu Hsi's proposal that topics like astronomy, geography, music and harmonics should be included as subjects of examination, a disciple even feared that "there may be no [qualified] examining officer after all."⁴⁵

It was natural, then, that Chu Hsi did not have very high opinions of the specialists. For him, they were merely technical experts in specialized areas which he did not master himself. Sometimes he even appeared confident that he could have mastered them if only he had tried. Such low opinions were reflected in his tendency to criticize his contemporary specialists whose understanding did not reach the high standard that he believed to have existed in the golden ages of ancient sages.

Finally, Chu Hsi's attitude to specialists was not same for all areas. For subjects like calendrical astronomy and harmonics, which he valued relatively more, and thus studied more and knew better, he did not quite accept the expertise of specialists. On the other hand, for other subjects that he did not know as much, he tended to accept the specialists' expertise, but, then, he did not value what they did very much. In fact, at times he did not hide his feelings of disdain and

43 *YL84.5a0*. See also *YL57.7a1*, 84.3b0.

44 For example, to his remark, quoted earlier, on the need to understand specialized subjects, he added: "Although one may not be able to see through their essences and subtleties, one should nevertheless know the general outlines..." *YL117.22b0*.

45 *YL109.8b0*. Chu Hsi's response to this was that one "should first order the examining officers to study them."

distrust toward specialists of certain techniques, called “the masters of the Way,” “the masters of methods” (*fang-shih* 方士) and “the yin-yang specialists” (*yin-yang-chia* 陰陽家).

5. Concluding Speculations: Chu Hsi and the Scientific Development in China

As Chu Hsi had such an overwhelming influence on Chinese thought in the subsequent period, it was inevitable that there have been many speculations about his influence in the scientific development in China. I shall conclude the paper with my own thoughts about such speculations.

Some scholars have seen positive aspects in Chu Hsi’s discussion of, and attitude to, natural phenomena and scientific subjects. For example, some saw scientific “method” and “spirit” in Chu Hsi, especially in his *ke-wu* endeavor. Hu Shih, for example, thought that a “scientific spirit” could be found in it. He saw in Chu Hsi’s *ke-wu* doctrine “a set of principles on the spirit, the method, and the procedure of investigation and research,” and went as far as characterizing it as “the method of hypothesis and verification by evidence.” Chu Hsi’s problem, for Hu Shih, was that this scientific spirit was directed exclusively to textual studies, and not to Nature.⁴⁶

Now, it is doubtful as to whether one can go this far in discerning the scientific spirit in Chu Hsi’s *ke-wu* doctrine. Nor is it fair to fault Chu Hsi for not doing what the European new scientists did in the Scientific Revolution — employing their “new” method in the study of Nature. But apart from these problems, there is a sense in which Hu Shih’s basic position itself is mistaken. For, in spite of the emphasis on investigating many concrete things, the *ke-wu* endeavor did not primarily involve intellectual procedures. In fact, man’s understanding of the

46 Hu Shih, “The Scientific Spirit and Method in Chinese Philosophy,” in Charles A. Moore, ed., *The Chinese Mind* (Honolulu: The University of Hawaii Press, 1967), pp. 104-131, originally presented at the Third East-West Philosophers’ Conference, held in Honolulu in 1959,. See especially pp. 116-118.

li of things, achieved as the result of *ke-wu*, was considered a kind of “resonance” between the mind’s *li* and the things’ *li*. This was so because the heavenly *li* (*t’ien-li* 天理) resides both in man’s mind (as the mind’s *li*) and in things and events (as their *li*). Thus, when a man has reached the *li* of a thing or an event, it was described usually as “seeing” the *li* rather than as “knowing” it. In other words, what he has gained was not so much a knowledge of the *li* as an insight into it.⁴⁷ Also, for such resonance to take place, the mind needs to be in certain states — “empty” (*hsü* 虛), “bright” (*ming* 明), and “tranquil” (*ching* 靜). These are the original states of man’s mind, manifesting the heavenly *li* fully, free from blockings by human desires (*jen-yü* 人慾). In such states, the mind spontaneously sees the *li* in things and events, which are nothing but manifestations of the heavenly *li* contained in the mind itself.

Moreover, gaining insight of the many *li* of individual things and events was not the real aim of the *ke-wu* endeavor, the ultimate purpose of which was to reach the heavenly *li* via the many individual *li*. The key step in the *ke-wu*, then, lay in moving from those individual *li* to reach the one heavenly *li*. Yet, the connection between the many individual *li* and the one heavenly *li* was not quite traceable. It was never clear exactly how the grasp of many individual *li* can lead to the apprehension of the one heavenly *li*.⁴⁸

All seemed to agree, however, that the step must involve something more than a purely intellectual process. In Chu Hsi’s words, one needs “laborious efforts” (*kung-fu* 工夫) and “nourishing” (*yang* 養) in addition to “knowing” and “understanding.” The mental state described by the term “reverence” (*ching* 敬) was important, for when a man is reverent, his mind is “bright,” “transparent,” and “alive,” all *li* are in the mind, and the heavenly *li* becomes “brilliant.” Thus moral and intellectual endeavors of a scholar converged in his search of *li* — the many individual *li* and the one heavenly *li* — through *ke-wu*. And in this conver-

47 Gardner, *Learning to Be a Sage*, pp. 46-53.

48 Kim, *Natural Philosophy of Chu Hsi*, Chap. 2.

gence the moral side was clearly the more important. Of course the intellectual aspect could not be ignored altogether, but, on the whole, the intellectual elements of the *ke-wu* endeavor were fused into its ultimately moral aims. It was to uphold morality and to avoid errors that one investigates things.⁴⁹

While Hu Shih focussed upon Chu Hsi's *ke-wu* doctrine and saw scientific method and spirit in it, Joseph Needham looked at the general character of Chu Hsi's world-view and called it "organic." This characterization is not unreasonable because Needham used the word "organic" in the sense opposite to "mechanical," and Chu Hsi's world-view is clearly more "organic" than "mechanical." And, as Needham further suggested, Chu Hsi's ideas might indeed have inspired Leibniz's philosophy of monad, and then the organic philosophy of Whitehead, whose congruence with modern science was emphasized by Needham.⁵⁰ But what we have here is nothing more than a possible, though interesting, case of inter-cultural influence and congruence. It would be wrong to proceed from this to conclude either 1) that Chu Hsi's world-view somehow had the character of

49 Moreover, Chu Hsi did not show much interest in methodological problems of knowledge. For example, he did not engage himself in discussions of how one can obtain knowledge or how one can be sure that what one knows is sound, the key questions in Western epistemology. When he did discuss "method," it was almost exclusively with the method of study, the so-called "method of reading books" (*tu-shu-fa* 讀書法) in particular. And there the target was the *li* contained in books. The problem for him was how to get at the *li* from the information recorded in books. How to know, or understand, what is recorded in books was not much problem for him. His was a "common-sense" epistemology, and at its basis lay the belief that man's mind in its original state can "spontaneously" grasp the ways and *li* of things and events. Nor was the method of discourse, i.e. method of presenting what one knows, much of a problem for Chu Hsi. He showed little concern with rigorous logical methods, for example. It was simply to be taken for granted that when one sees something or reads something in a book, one knows it, and that when one knows something, one can talk or write about it. What mattered to him was not how to obtain knowledge, or how to present it to others, but, rather, how to set one's mind upon the knowledge, or how to act upon it. This was indeed the direction that the *ke-wu* doctrine took, as we have seen. See Kim, *Natural Philosophy of Chu Hsi*, Sec. 14.4.

50 Needham, *Science and Civilisation*, vol. 2, p. 505.

modern science which has overcome, or shed itself of, the predominantly mechanical character of the Newtonian “classical” science, or 2) that it is a desirable world-view for people to have in the modern world plagued by many problems created by the “mechanical” science.

To be sure, it is true that the modern science has a relatively more “organic” character compared to the classical science. Yet this “organic” character of modern science is of a level completely different from that of Chu Hsi’s world-view. Although modern science does not depict the natural world in such a completely mechanical way as classical science did, it has not forsaken its mechanical character to such an extent that it has become similar to Chu Hsi’s world-view. Modern science remains to be essentially mechanical, though less so than classical science.

To characterize Chu Hsi’s world-view as “organic” is misleading also if it is interpreted as a systematic world-view in which everything finds its proper place in a harmonized whole. For, in fact, Chu Hsi’s world-view was rather particularistic. He treated most natural phenomena, and problems involving them, basically as particulars; he did not generalize from them, as he took each phenomenon or problem as it came along, without much concern to correlate it with his views about the rest of the natural world.⁵¹ And in this respect, the medieval European world-view was far more organic than Chu Hsi’s. This can be seen clearly if we look at the way Chu Hsi dealt with a few problems and phenomena related to the idea of weight and compare it with what the medieval European scholastics did. Chu Hsi noted that water tends to move downward, which is similar to the views of the medieval scholastics in that whether an object falls or rises is determined by what material substance it is made of. But Chu Hsi’s was not a general idea applicable to all heavy and light objects. To flow downward, for him, was an innate tendency of a particular substance, water, and not of all heavy objects. It is even unclear whether he realized that the downward flow of water is a particular case of the fall of heavy objects. Furthermore, for the medi-

51 Kim, *Natural Philosophy of Chu Hsi*, Sec. 14.3.

eval scholastics, the fall of heavy objects and the rise of light objects were tied with their conceptions of the structure of the world: heavy things fall down as they tend to their natural place, the center of the earth, which, for them, was the center of the world. Thus, the problem of the weight of the earth, i.e. the cause for the stability of the heavy earth in the middle of the sky, never arose for the scholastics. The concept of weight was built into their world-picture itself; the earth, made of the heaviest of the four elements, lies at its natural place, the center of the world, and thus does not move. But Chu Hsi, for whom the problem of weight was separate from that of the structure of the world, had to deal with the problem of the earth's weight. Whereas the scholastics' world-picture included the particular empirical fact of weight as an integral part of it, Chu Hsi's had to take account of the notion of weight as an additional and independent fact.⁵²

Of course, there were negative judgements on Chu Hsi's influence also. This is inevitable because Chinese science is frequently considered to have begun to stagnate just when the Chu Hsi orthodoxy became dominant.

One source of the problem could be the categorical and associative conceptual schemes of Chu Hsi's natural philosophy: yin-yang, the five phases, etc. Needham, for example, believed that the sixty-four hexagram system of the *I-ching* was a "hindrance" to the development of scientific ideas, while the yin-yang and the five-phase schemes "helped" it. Graham, on the other hand, thought that the five-phase associations, unlike the yin-yang characteristics, lacked objectivity and thus were not given much attention to, perhaps because they were felt to be "less useful in practice."⁵³

Yet, Chu Hsi's knowledge of the natural world was not completely condi-

52 Kim, *Natural Philosophy of Chu Hsi*, Sec. 13.2. For a brief account of the medieval Western world-picture, see Edward Grant, *Physical Science in the Middle Ages* (New York: Wiley, 1971), Chaps. 4-5.

53 E.g., Needham, *Science and Civilisation*, vol. 2, p. 304; A. C. Graham, *Two Chinese Philosophers: Ch'eng Ming-tao and Ch'eng Yi-chüan* (London: Lund Humphries, 1958), p. 33.

tioned by these conceptual schemes. It was never Chu Hsi's intention to use these schemes in constructing a coherent system of natural knowledge covering all the particulars; they were not the sole means for explaining natural phenomena. Thus, the presence of the schemes should not lead one to ask, or to answer, such questions as to whether the yin-yang — or the five-phase, or the *I-ching* diagram — schemes “helped” or “hindered” the understanding of natural phenomena. For, when alternative means of explanations, not employing such schemes, were available, they could always be adopted. The categorical schemes could not hinder, inhibit, or stand in the way of, the adoption of such explanations.

Consider the example of the yin-yang scheme, for example. Chu Hsi used it in explaining numerous natural phenomena. The idea of the yin-yang cyclical alternation dominated his discussions of such phenomena as lunar eclipse, seasonal characteristics and sea tides. But he was not forced to use the idea of yin-yang alternation in explaining all such phenomena. When he could adduce a more concrete explanation, he could adopt it. His explanation of the phenomenon of moon's phases is a good example. He chose to account for it in terms of the relative positions of the sun and the moon even though the yin-yang alternation could have easily explained it. Thus, what “prevented” Chu Hsi from reaching the “correct” explanation of the phenomena like the lunar eclipse and the sea tide must lie elsewhere — perhaps in the difficulties that the correct explanation posed, or in the lack of additional knowledge necessary for it.⁵⁴

Similar things can be said about Chu Hsi's use of the five-phase scheme. Consider his discussion of the five regular and the five intermediary colors, for example. Chu Hsi had a rather long discussion in which he spoke of the production of “the five intermediary colors” (*wu-chien-se* 五間色) by mixing various

54 The “correct” understanding of the tidal phenomena, for example, required knowledge of gravitation and of the earth's rotation, which Chu Hsi could never have imagined. In the absence of such knowledge, some medieval Europeans also resorted to the idea of “microcosmic-macrocosmic respiration.”

pairs of “the five regular colors” (*wu-cheng-se* 五正色):

Blue, red, yellow, white and black are the regular colors of the five [compass] directions. Green, vermilion-red (*hung* 紅), emerald-blue (*pi* 碧), violet (*tzu* 紫) and horse-brown (*liu* 驪) are the intermediary colors of the five directions. Now, with blue of Wood [one can] conquer yellow of Earth. [Thus,] combining blue and yellow produces green and becomes the intermediary color of east. With white of Metal [one can] conquer blue of Wood; combining blue and white produces emerald blue and becomes the intermediary color of west. With red of Fire [one can] conquer white of Metal; combining red and white produces vermilion-red and becomes the intermediary color of south. With black of Water [one can] conquer red of Fire; combining red and black produces violet and becomes the intermediary color of north. With yellow of Earth [one can] conquer black of Water; combining yellow and black produces horse-brown and becomes the intermediary color of center.⁵⁵

But Chu Hsi was not interested in the actual processes in which the colors are mixed to produce new ones. What prompted him to discuss this was the problem of proper colors to be used for clothes of great men.⁵⁶ It is natural, then, that he should be interested in classifying the colors — according to whether they are “regular” or “intermediary,” and according to their five-phase associations. Thus, the five-phase scheme did not play the role of a coherent theoretical framework covering all phenomena involving color. It was only because Chu Hsi on this particular occasion was concerned with colors for gentlemen’s clothing, a problem for which certain five-phase associations were well suited, that he brought in the five-phase scheme. Moreover, the five-phase concepts and asso-

55 *WC*32.12a.

56 The difficulty to imagine that some of the intermediary colors can be produced in the manner described by Chu Hsi — violet from red and black, horse-brown from yellow and black, for example — also bespeaks his lack of interest in the actual process of mixing colors.

ciations were ambiguous enough to accommodate any particular color phenomenon and any interpretation of it in the scheme.

On the whole, it is difficult, perhaps not possible, for us to judge whether Chu Hsi's influence was positive or negative. For it is difficult to come up with a single unambiguous judgment on all the various aspects in which Chu Hsi's knowledge, attitude, method, style, etc., influenced the way Chinese in the subsequent period dealt with the object and phenomena in the natural world.

For example, even the great range — breadth and inclusiveness — of his natural knowledge cannot be unambiguously considered to have been beneficial. For paradoxically, the very breadth of Chu Hsi's intellectual scope may have been a factor in the subsequent narrowing of the interest among scholars. His followers could have felt that everything they might wish to know about the natural world had already been included in the corpus of their master. It was almost as if, once Chu Hsi had produced a corpus of knowledge that covered everything, those who came after him did not feel the need to worry about problems other than their principal concern, morality and self-cultivation; everything else, including knowledge of the natural world, was already there in Chu Hsi after all.⁵⁷

Finally, there is more fundamental, perhaps an ultimate question to ask. To judge the role of Chu Hsi in the development of science in China is essentially to ask what would have happened to science in China if Chu Hsi had not lived in China. But would it then be meaningful at all to speak of China without Chu Hsi? Can “China without Chu Hsi” still be considered China?

57 Yet, in view of what we have seen in previous sections, what happened turns out to be not so “paradoxical” after all. We have noted, for example, that most natural phenomena were obvious and unproblematic for Chu Hsi, and were simply accepted by him. We have also noted some characteristics of his basic ideas and assumptions that could have facilitated this attitude. In a sense, in ignoring natural phenomena, Chu Hsi's followers followed Chu Hsi himself, who was not concerned very much with the detailed knowledge about objects and phenomena of the natural world that he took for granted.

朱熹論自然與科學

金 永 植*

摘 要

我們對「科學」的認知，在朱熹的學說中橫跨天文、律曆、醫術、五行、地志、象數等等專門學科以及一般自然哲學的主題。然而，這些學科卻無法在朱子學說中形成一致，甚至於沒有一個大體的概念可以涵蓋以上的種種、卻又能符合我們對科學的認知，它們只是朱子學說眾論說中的一部份，而這些論說又不受限於自然學的範圍。

朱熹學說中，宇宙是由天地、萬物、與人的錯綜關係所構成。這三者所構成的宇宙涵蓋有形及無形的一切。存在於天地萬物人之間的物體，其自然與非自然之間的界線含糊不可辨別。朱熹認知中的「自然」並非一個整體，而是一個整體中的一部份，與人世及社會並存。在自然中存在及運作的一切，是理所當然的現象，因此朱熹認為對它們的存在不必加以闡明。正因為自然中的現象是當然現象，所以朱熹在談論社會倫理問題時，常會引用自然現象來針對問題的所在。

朱熹的一些基本概念及觀點，如氣、理、陰陽、五行等等，是他視自然現象為理所當然之事的根源。以「氣」來說，它的存在及運作是與生俱來的，因此，凡是因「氣」而生的現象是沒有潛在因素。而事物中的「理」卻是事物的整體，事物因為「理」的存在而存在。

朱熹對眾多專門學科深感興趣。而在某些學科領域中，他已達到精通的

關鍵詞：朱熹、科學、自然、新儒學

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境界。對於不同的學科，朱熹持有不同的看法，可是他卻一致認為都必須去學習這些學科而不能忽視它們。這種看法與他的格物論——亦即「即物而窮其理」，強調凡與人有關的所有具體事物，都必須探討——有密切的關係。這些學科不但與哲學觀念有關，而且經常在文集、經書的注疏、及史書中出現而廣為學者研習。

可是，朱熹對自然的認知並不受制於這些學科。它們亦非為了解釋自然現象而存在於朱熹論說中，它們的存在往往是為了闡明聖人的思想。因此，我們無法斷定朱子思想在中國科學發展上是具有正面或負面的影響，因為在他的學說、觀點、方法中很難斷言某一方面確切足以影響後世自然學。