Pierre Huard and Ming Wong

RELATIONS BETWEEN MAN AND THE WOLRD

The relationship man-world is of very great importance for the primitive man who finds himself perpetually (even when deeply engaged in mechanical or technical pursuits) in a state of subjective participation with his milieu. No distinction whatsoever exists for him between the self and the world, but rather a constant and intimate liaison, made real by a mythical behavior which leads us to consider the myth as the most archaic stage of knowledge (Leenhardt).

Prehistoric myths were prolonged in the cosmologies by which the civilizations of ancient Asia tried to contemplate the world under the category of totality. The procedure of their attempts was the opposite of that of contemporary science, whose attitude is extroverted. They accounted for phenomena by projecting upon them, lacking all objectivity, their own sensory, emotive, imaginative, or intellectual reactions as well as their own subjective notions, introverted in value, of hierarchy and order. Pushed on by an invincible anthropomorphic tendency, they constructed a humanized nature by means of analogical deduction.

The fact is that if everything can be studied in its immediate function by observation and experiment, its transcendental meaning can also be sought, leaving aside all notions of cause and effect. A simple "short circuit of

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thought" (Gilson) permits one, basing his thought on a chance similarity of color, form, temperature, or degree of humidity, to connect the object with another element of the cosmos, whose essence one thus succeeds in penetrating.

Thus, all ancient cosmologies held that the human body (microcosm) was a replica of the universe (macrocosm) so that the same soul, the same component elements, and the same kinetic mechanisms were valid for both.

Although this macro-microcosmic symbolism is at bottom but a simple association of ideas, it is a respectable part of the history of civilization. It gave the world an image of incomparable ethical and aesthetic value by introducing a hierarchical subordination and an irreproachable order of a unity much more rigorous than that suggested by the modern mathematization of the cosmos (Johann Huizinga).

A. MORPHOLOGICAL ANALOGIES BETWEEN MICROCOSM AND MACROCOSM

1. Since Zoroaster (*ca.* 585 B.C.) innumerable analogical series have been imagined connecting the parts of the human body with those of the cosmos or with the different parts of the state. A comparative analysis of these is beyond the limits of this study, and we can only indicate the immense amount of material to be studied in the Far East, India, the Middle East, and the West, in classical science as well as in such pseudo-sciences as astrology and alchemy. We shall come back to this apropos of macro-microcosmic correspondences. Joseph Needham has shown that the two first European books devoted to this subject are those of Joseph Ben Zaddig (Córdoba, 1149) and of Bernard (Torus, 1150). Their common source is an encyclopedia written a hundred years earlier at Bassorah. Needham also established the fact that John of Salisbury (Policraticus, 1159) was the first Western man to point out analogies between the human and political structure, a subject which had already been considered in China by Ko Hong (281–361) in the *Pao P'ou Tseu.*[1]

2. On another level, analogies between the color or the form of a plant or a mineral and those of an organ or a humor produced therapeutic deductions. This is the doctrine of "signatures" still being developed by Crollius in the seventeenth century.

The mandragore in the eastern Mediterranean area and the ginseng in the Far East owed their enormous reputations to the anthropomorphic

1. J. Needham, "Relations between China and the West in the History of Science and Technology," *International Congress of the History of Science* (Jerusalem, 1953).

aspect of their roots. For Paracelsus, the celadine was a cholagogue because of its yellow, bilious latex. But on the other side of the globe, in Indonesia, the rhizoma of curcuma was for the same reason considered as a hepatic medicament and used by J. Bontius in the treatment of jaundice. And it is noteworthy, from a pharmacological point of view, that mandragore, ginseng, and curcuma do have real therapeutic value.

The Galilean and Newtonian epoch was to defend the conception of ether in physics (Descartes, Newton) and in medicine (Hoffmann). But to the subjective system of elementary[2] and qualitative categories, it was to oppose matter,[3] the only objective reality which can be measured and weighed, and thus to return to the old theory of the vacuum and atoms (Gassendi). Descartes, proclaiming that material bodies share everywhere a likeness to each other, renders absurd the alchemist's idea of transmutation and ruin. But if physics makes "essential qualities" absurd, the idea of the element remains very important, whether the old elements still permit the construction of scientific systems, or whether new elements affirm their existence.[4]

All these notions gave rise to artistic expression differing greatly between the Occident and the Orient. For the Greeks the microcosm is the measure of all things, and the glorification of the nude human form is the grand theme of art. Feminine beauty became the plastic symbol of the highest conceptions of Europe (religion, science, fatherland, humanity). For Asia, on the other hand, the macrocosm is the only real inspiration of art. The conscious and constant aim of Indian art has been to render the divine and the transcendental by creating morphological forms "beyond human forms." In the Far East, painting, sister of calligraphy, leans toward vegetable forms, animals (including insects), and landscapes. It is less concerned with showing a reproduction of nature than with eliminating all that is not conducive to a suggestion of the great cosmological myths (opposition of the two principles; idea of nirvana; eternal change).

2. "Sweet, bitter, hot, cold, color are but conventions. Reality is atoms and vacuum" (Democritus).

"These tastes, these odors, these colors, etc. . . . in relation to the object in which they seem to be found are nothing but simple names" (Galileo, *Il Saggiatore* [1623]).

3. "It may be that a single and unique fundamental matter, dispersed, divisible yet impenetrable is the basis of all bodies, and that the differences we perceive among them are but the result of unequal sizes and forms, of rest and movement, and of the relative position of the atoms" (R. Boyle, 1627–91).

4. R. Nooykass, "Elementelehre des Iatrochemiker," *Janus*, 1937.

B. STRUCTURAL ANALOGIES BETWEEN MICROCOSM AND MACROCOSM

1. The innumerable aspects of material bodies, of plants, animals, and men can be reduced to some common principles, as few in number as possible, known as elements and atoms. Elements constitute not only cosmic substances but, by contrasting with each other in their opposite qualities, antinomic series which are balanced, attract or repel each other, and are created or destroyed in a circular movement, so that nothing is lost or created, and which, in a mechanistic sense, explain both the permanence of beings and the infinite diversity of nature, as well as the possibility of the transmutation of matter (theoretical justification of alchemy).

The Greek theory of elements is quaternary (water, fire, earth, air); that of India is quinary (emptiness, wind, fire, water, earth) with higher (six) or lower (four) variants; in the Far East the theory is quinary, but with different elements (water, fire, wood, metal, earth). The quinary theory was an important innovation, introduced by Tseu Yen (*ca.* 336–280 B.C.), but the elements did not supersede the two principles (*Yin* and *Yang*) which remained the keystone of Chinese cosmology.

2. Certain Greco-Indian schools of philosophy criticized the theory of elements and tried to replace it by the atomic theory, much closer to modern theory. The attempt, which failed, is mentioned only in passing.

3. The Stoics and Aristotle followed the quaternary theory but doubled the element of fire. The former distinguished two sorts of fire: that of heaven (*pur teknikon*), which is ether, and that of earth (*pur ateknikon*). Like the Pythagoreans, they admitted the transmutation of elements as a consequence of the continuous change of things. Thus the *aer* or *pur ateknikon* is susceptible to transformation into igneous and luminous *aither* (cf. Cyril Bailey, *The Greek Atomists and Epicurus* [Oxford, 1928], and Jean Beaujeu, *Pline l'ancien, histoire naturelle II*, p. 123). They likewise admitted for the element of air a spiritual part, the *pneuma*, half-air, half-fire, indispensable to the maintenance of the vital activities in living organisms. Aristotle constructed a dialectico-logical theory of the four elements and the four qualities. He completes it, however, with a fifth element, *aither*, or pure fire, which is not of the same nature as earthly fires.

4. Galen adopted in large part the Aristotelian system. To the element of fire corresponds innate heat. Its origin is in the heart, compared to a hearth providing at the same time fire and smoke (dusky vapors, as it were, eliminated from the body by expiration). The temperature of the left ventricle therefore is necessarily considered higher than that of other parts of the body.

The Arabs kept the quaternary theory but added a ternary system (sulfur, salt, mercury) which was to be viewed with favor during the Middle Ages in Europe, by the Paracelsians, and on to the time of Robert Boyle.

5. The occidental Middle Ages accepted for the most part the Arab doctrines; for St. Thomas Aquinas the Aristotelian *aither* is "subtile air" confined to high altitudes. The theory of the four elements is also a basis for the distillations of Arnaud de Villeneuve (*De vinis*) and Raymond Lully (1235–1315). The latter submitted plants to a quadruple distillation. The first separated the couple air-water from the residual couple fire-earth. The second (using a double boiler) isolated air and water. The third, operating on the pulverized residue, dissociated earth from fire, which was generally mixed with water. A fourth operation gave a pure fire (oil) from which every trace of water (phlegm) had been eliminated. Thus was obtained the quintessence, the vegetal soul or fire, of plants. These attempts were continued by Basile Valentin (*ca.* 1413). The latter added to the sulfur, mercury, and salt of the Arabs a fourth spiritual element—the central fire or life principle (*arche*).

6. During the Renaissance, Paracelsus[5] (1493–1541) was inspired by the Neo-Platonic doxology, imported from Constantinople by Gemistus Pomponius, Laetos, and Marsilio Ficino, and also by the Cabala and by alchemy. His apparently revolutionary notion of the three principles (sulfur, mercury, and salt) is in reality connected with the age-old quaternary doctrine. The *Tria Prima*, as a matter of fact, are but the terrestrial and chemical manifestations of fire, air, water, and earth. For example, the body of sulfur is fire, and there exists a perpetual cycle of exchange between elements and principles. The notion of philosopher's sulfur (*sulphur embryonatum*) contains the germ of the *phlogiston* theory.

7. In modern times the complexity of the earth element became evident (Van Helmont), while the fire element continued to be of great importance.

a) Let us recall that the Atomists and the Epicureans are the creators of the fire-matter theory, declaring that flame is an outflowing of miniscule bodies which, becoming less and less dense, are invisible but which remain perceptible through the sensation of heat, giving rise to the belief that combustible bodies either contain the fire element in their substance or are transformed into fire. This belief is prolonged in the notion of the fire

5. Cf. F. M. de Feyfer, "Paracelsus," *Janus*, 1941; Nooykass, "Die Elementelehre des Paracelsus," *Janus*, 1935.

element and its essence, phlogiston, basis of seventeenth-century physico-chemistry (Descartes, Lemery, Boerhaave).[6] Boyle believed that the increased weight of heated metal came not from oxidation but from ignification through combination of fire with the metal through the wall of the crucible (1673). Lavoisier (1774) was to show the error of Boyle and the lucky predictions of J. Rey (1630).

b) In physiology Harvey and Descartes, despite their differences, believed like Galen in the fire element. "The element of fire resides in the heart. Each time a large drop of cooled blood reaches a ventricle, encountering the ardent heat of the fire principle, it expands and is vaporized so that, occupying a larger and larger space, it distends the ventricles, causes their walls to expand and the sigmoid valves to open, and flows into the arteries." This is Descartes's explanation of the emptying of the heart in diastole (cf. Chauvois, "Un Colloque: Harvey Riolan, Descartes," *Presse medicale*, 1955, n° 7).

"The heart is the tutelary hearth which contains and conserves natural heat and the elements of fire. . . . It gives back heat and the vital spirit to the chilled and exhausted blood of the veins" (Harvey).

Borelli had only to plunge a thermometer into the left ventricle of a living stag to show that the temperature of the heart, contrary to the opinion of Galen, is not higher than that of the liver, the lungs, and the intestines. Stenon was to prove that the heart is but a muscle like so many others.

In animal mechanics Borelli had demonstrated that the strength of a bird's flight is due to its pectoral muscles, which constitute one-sixth of body weight, while the human pectoral muscles represent but 1 per cent of its mass. This notion is taken up by J. B. Verduc (*Nouvelle ostéologie où l'on explique mécaniquement la formation et la nourriture des os: Avec une dissertation sur le vol des oiseaux et le nager des poissons* [2d ed., 1693]) and by Diderot (*Encyclopédie* [1772]). Nevertheless de Vivens (*ca.* 1742) still maintained that birds fly by virtue of the fire element, with which they are abundantly endowed, much more than through the action of their wings.

In pathology the physicist Rabiqueau (1753) explained as follows the death of his colleague Richmann, killed by lightning in St. Petersburg: "The pure fire forming the lightning united with the vital fire of M. Richmann, depriving him at the same time of air, so that there remained nothing but matter incapable of life."

6. Milton Kerker, "Herman Boerhaave and the Development of the Pneumatic Chemistry," *Isis*, March, 1955.

In therapeutics the particles of fire contained in lukewarm water were considered capable of augmenting the "vital force" and thus of eliminating the danger of burying a patient alive. So J. P. Brinckmann (1746–85) injected lukewarm water into the jugular vein in case of apparent death.

It took the discovery of oxygen to put an end to the phlogiston theory. After Lavoisier, heat and fire were separated, heat becoming a product of the degradation of kinetic energy (Mayer, 1842; Joule, 1843).

8. Air and water as elements did not long survive the fate of the fire element. In the second half of the eighteenth century, the word "gas" acquired its present meaning, and Lavoisier showed that the term "air" or its substitutes (vapor, elastic, or aeriform fluid) designates not an element but a state of matter. Air then appears as a mixture of which Van Helmont had identified one of the constituents (*sylvestre* or carbonic gas, 1640). Ascending in a balloon to 7,000 meters, Gay-Lussac (on the 29th Fructidor, twelfth year of the revolutionary calendar) gathered air and showed that its composition at high altitudes is the same as at ground level. Thus disappeared Aristotle's *aither* and St. Thomas' "subtile air."

The decomposition of water by Cavendish in 1766, interpreted by Lavoisier in the "water controversy," permitted the latter to show that water is a combination of two gases ("flammable air" and "vital air"). While the old elements were being eliminated from chemistry, new elements whose existence the Greco-Latin world had never suspected became known (gold, R. Boyle; carbon, Réaumur, Duhamel du Monceau, Bergmann, Scheele, Berthollet, Lavoisier).[7]

C. ANALOGY BETWEEN THE SOUL OF THE MICROCOSM AND THAT OF THE MACROCOSM

In ancient civilizations breathing was considered as the test of life itself, and the soul assimilated to the vapor which left the still warm blood and visceral cavity. Air, the soul of the macrocosm, also maintained the life of the microcosm. Respiration was thus the function uniting man to the cosmos and renewing his organic activities by the absorption of the vital breath (Greek *pneuma*, borrowed from the Egyptians, Latin *spiritus vitalis*, Indian *prâna*, Chinese *k'i*, Greek arteries and veins) which assured health; its stoppage determined the nature of illness (penumatic pathology). A better impregnation of the organism by the vital breath facilitated the union

7. Clara M. Taylor, *The Discovery of the Nature of the Air and Its Changes during Breathing* (London, 1923); Nooykaas, *The Concept of Element* (Utrecht, 1933); J. Schraeter, "La Découverte de la composition chimique de l'eau," *Revue Ciba*, 1946–48.

of the organism with the cosmic and created, physically, a state of super-health and, psychologically, a state of ecstasy. Thus the extreme importance attached to respiratory techniques from the Pacific to the Mediterranean, which are the basis of the training of Japanese Zen-Buddhists, of Chinese Taoists, of Hindu Yogis, of Iranian soufis and the monks of Mount Athos, adepts in Hesychastic prayer. The pneuma was believed to accompany the blood and the humors, passing through the vascular system, which it animated with beats (pulsations) similar to respiration. Taking the pulse gave one an idea of the functioning of all organs (Egyptian, Chinese, Greek, Arab, and occidental pulsology). The Chinese compared the passage of the pneuma to the circular movement of the stars and calculated it with the help of numbers which represented not concrete distances but cosmological values. This hypothesis was rejected by the Greeks. "Circulation" being an attribute of the stars, the movements of earthly bodies could only be rectilinear and that of the blood comparable to the ebb and flow of the ocean (Galen), a notion which was to endure to the time of Harvey.

Greek pneumatic doctrine survived nearly two thousand years, and Galen remained an important author more or less in favor until the eighteenth century. The "animal spirits" of Harvey and Descartes, become in the following century nervous fluids and sap (Hoffmann), were not rejected by Western medicine until after Haller, Tissot, and V. Sommering; then medicine, having assimilated and surpassed antiquity (about 1816), was able to move forward again.[8]

D. MICRO-MACROCOSMIC CORRELATIONS

The identity of elements in the three terrestrial kingdoms permitted the establishment of classifications and correlations among minerals, vegetables, animals, and man; minerals had, until Linnaeus, been considered as congealed life, therefore as sexed and capable of reproduction and transformation. But as soon as the Chaldean *mathematici* had created astrology, that is, explained the determinism of earthly events by the movement of the stars, new cosmological connections between microcosm and macrocosm were established.

The idea of a correspondence sun-gold attracted attention toward lizards, which were believed to drink the light of the sun. Gerbert d'Aurillac

8. Cf. Ch. Lichtenhaeler, *Les Dates de la renaissance médicale: Fin de la tradition hippocratique et galénique* (1952); P. Huard and M. Wong, "La Notion de cercle et la science chinoise," *Archives internationales d'Histoire des Sciences*, 1956.

and Pierre des Vignes ground these animals with mortar and pestle in the hope of finding the essential gold of the sun's rays. Gold was also to be considered a specific for maladies of the heart because of the relationship sun-heart.

The relation seen by the Arabs among moon, silver, and brain gave theoretical basis to the treatment of "lunatics" and maladies of the central nervous system by silver salts (lunar tincture, lunar caustic), a practice still followed at the end of the nineteenth century.

The pre-Hellenistic Greeks, preoccupied as they were with causality and the successive chain of facts, were lukewarm toward these considerations, which they preferred to classify in vertical diagrams. The Chinese expanded them considerably. The Arabs made of the astrolabe a medical instrument and placed such importance on the influence of the stars that they paid closer attention to the state of the sky than to the state of the patient. The spread of "zodiacal men" shows the influence of these conceptions on men like H. de Mondeville and Guy de Chauliac. The plague, syphilis, and influenza (*influencia astrorum*) were, from the fourteenth to the seventeenth centuries, attributed to the conjunction of stars with comets and meteors. Knapp (*New York Medical Journal* [1878]) still supported this pathogeny of epidemics. For the Chinese the constituent parts of the world form a network whose single elements, taken in isolation, are of no interest: only the whole matters. Thus the idea of correlation between macrocosm and microcosm led to a very complex horizontal system in which organs, breath, humors, notes of music, the seasons, elements, points of the compass, stars, etc., were grouped according to norms which, although simply emblematic, were considered as essential and valid in politics, biology, or military tactics. The result is a unique order, born of civilization itself (M. Granet).

A. Forke (*World Conception of the Chinese* [1925]) has shown the extent to which mystic European biologists (Paracelsus, Agrippa de Nettesheim, R. Fludd, etc.) had proceeded in the Chinese fashion in manipulating solidarities and polyvalent equivalences in which they had vastly increased their repertoire without in any way augmenting the subject matter of science. J. Needham brought new supporting arguments to this thesis.[9]

E. EVOLUTION OF THE RELATIONSHIP MAN-WORLD IN THE OCCIDENT

The "great democracy of the being," that indivisible solidarity of all living organisms (Max Schuller) in which, thanks to macro-microcosmic con-

9. J. Needham, *Science and Civilisation in China* (Cambridge: Cambridge University Press, 1954 and 1956), Vols. I and II.

ceptions, man was joined to gods, animals, and vegetables by his rational, sensitive, and vegetative souls, an idea common to China and to Greece, was broken by a series of important changes in occidental science, techniques, and personality structure.

1. The great discovery of the Greeks (fifth century B.C.), reason, "which owes but to itself the norm of its certitude" (Léon Brunschwig), isolated in the cosmos a part without a soul—"matter," which obeys a finality. Nature being intelligible (idea of progress), man is able to act upon her by knowing the causal laws to which material objects are subject and, consequently, to impose his will upon her. Thus appeared the "Promethean" spirit which was to impel occidental man to construct within the universe an artificial world, obedient to his aims.

2. Christianity, by establishing an absolute distinction between God, on the one hand, and the world, on the other, continued to detach man from the universe in order to attach him to God. The sacred aspect which paganism had externalized in nature becomes internalized in the heart of the Christian. And the "desacralized," "desymbolized" external world becomes for man a simple object available to his curiosity and his desire.

3. The scientific revolution of the seventeenth century led to a mechanistic schema of the world favorable to the extraversion of thought oriented along the myth of progress and liquidating the traditional feeling of man's dependence vis-à-vis the cosmos. He leaves its service to become its master. The cosmological conception of culture is ruined. There is a tendency toward the elimination of every mystic or religious factor, an eventuality which had never before presented itself throughout the course of history.[10]

4. The eighteenth century saw the first total scientific discovery (Lavoisier, 1777) valid at once for physics, chemistry, and human, vegetable, and animal physiology (Vendryès), and in the nineteenth century brought with it the notion of metabolic and geochemical cycles (carbon, nitrogen, sulfur, oxygen); the Darwinian conception of human origin; the knowledge of meteoro-pathology, showing close and multiple correlations existing among the three natural kingdoms. But these scientific notions in no case led back to a transcendence of macro-microcosmic realities. On the contrary, in biology man became again a "unique being" (J. Huxley). The three industrial revolutions—of steam (1760–1860), of electricity and the internal combustion engine (*ca.* 1884), and of the atom (*ca.* 1945)—led to an increasing mechanization of the world, in which the body and

10. Hall, *The Scientific Revolution, 1500–1800: The Formation of the Modern Scientific Attitude* (London, 1954).

the life of man himself are but collections of objects among so many others which must be classified, organized, and, above all, utilized (Ph. Aries).[11]

5. The total separation of the microcosm from the macrocosm, a condition essential to man's power, presents, nevertheless, undeniable psychological difficulties. The future will show whether they can be easily surmounted. A return toward antique anthropomorphism can already be noted (a return which is not necessarily a step backward) in an attempt to find once more in cosmic unity, lost for so long a time, the relationship between the human and the natural order (Guillaume).[12]

11. *Histoire des populations françaises et de leur attitude devant la vie depuis le XVIII^e siècle.*

12. *Introduction à la psychologie* (Paris, Vrin, 1946).

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