

On the Needham Problem from the Division of Physics Philosophy in the 17th Century

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Abstract: From the deep structure of the history of scientific thought, this paper discusses the classical Needham puzzle, that is, why the modern scientific revolution did not take place in China. Focusing on the foundation period of the European scientific revolution in the 17th century, this paper proves that the birth of modern science has profound metaphysical particularity by comparing the fundamental division between Chinese and Western philosophy of physics (or natural philosophy). The paper holds that the breakthroughs of modern science in Europe are rooted in a unique set of philosophical presuppositions: A “mechanistic cosmological view” that is mathematical, composed of particles of matter, and follows the universal external law established by God. This world picture encourages abstraction, quantification, experimental decomposition and causal reduction of nature. In contrast, China’s mainstream natural philosophy is a kind of “organic cosmological view,” which regards the universe as a life network composed of “Qi” and ganying, and its exploration mode tends to grasp relevance, mode, and dynamic balance, rather than to find universal and linear causality. This paper concludes that the fundamental differences between the two world views in ontology, epistemology, and methodology lead to different evolutionary paths of the knowledge system between China and the West. Modern science is not the inevitable product of universal rationality, but the fruit of the special philosophy of “mechanics.”

Keywords: Needham puzzle; Scientific revolution; Philosophy of mechanics

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1. Introduction: Surpassing “Advanced” and “Backward,” reviewing the philosophical dimension of the “Needham Problem”

In his immortal book *Science and Civilization in China*, British scholar Joseph Needham systematically revealed that ancient China had long been ahead of the world in terms of experience, technology and scientific observation, on the one hand, and raised the question of the century still echoing: Why did China’s scientific development tend to stagnate after the 15th century, while a subversive scientific revolution erupted in Europe after the Renaissance ^[1]?

The answer to the Needham puzzle comes out endlessly, covering many aspects such as social structure, economic form, political system, and even language. However, as Toby Huff, a historian of science, points out, one of the most neglected underlying factors lies in the fundamental differences between civilizations in law, society, and philosophy. This paper attempts to start from this perspective, but focuses more on the core of the scientific revolution - physics - the

philosophical basis behind it. This paper argues that modern science should not be regarded as a universal standard that all civilizations should meet, but China “fails” to meet. Through a deep analysis of the cornerstone of the mechanical philosophy of physics in Europe in the 17th century and the exploration of the natural philosophy of organic theory in the same period in China, we can reveal the inherent logic and fundamental differences of the two knowledge paths, thus providing a more compassionate understanding (empathetic understanding) framework for the Needham puzzle.

2. The metaphysical foundation of modern science in Europe

The scientific revolution in the 17th century was not so much a revolution of observation and experiment as a revolution of worldview. Galileo, Descartes, Boyle, Newton, and other thought giants are not only scientists, but also philosophers. They constructed a new set of metaphysical presuppositions for modern science, but often implicit.

2.1. The mathematics of nature: The inheritance from Plato to Galileo

One of the core characteristics of the scientific revolution is the natural “mathematics.” Galileo’s famous phrase, “Natural philosophy is written in mathematical language”^[2], proclaims a new kind of epistemology. The idea is that the true structure of the universe is geometric, and its fundamental reality (first) is the properties that can be mathematically quantified, such as size, shape, number, and motion. Attributes that cannot be quantified, such as color, odor, cold and hot (secondary), are considered secondary and subjective. This distinction between “first sex” and “second sex” paves the way for scientists to abstract complex natural phenomena into pure mathematical models. From Kepler’s description of planetary motion in elliptical orbits to Galileo’s expression of the law of falling bodies in quadratic functions, this idea is a great practice.

2.2. Philosophy of mechanics: The universe as a clock and everything as a particle

Parallel to mathematics is the natural “dechantment” (disenchantment). The “corpuscularianism” or “philosophy of mechanics” developed by Descartes, Boyle, etc., likens the entire material world (including plants and animals and the human body) to a huge, sophisticated machine, like the self-ringing bell of Strasbourg Cathedral. In this model, the universe is made up of particles of inert matter that have no inner life, will, or purpose, and all natural phenomena, whether planetary motion or chemical reactions, can be explained by, and can only be explained by, mechanical movements such as collisions, combinations, and separations of these particles. This worldview completely excludes the concepts of “spiritualism of all things,” teleology, and mysterious induction, which existed in ancient and medieval times, and makes nature become a purely physical system that can be objectively analyzed, disassembled, and reduced to research^[3].

2.3. The concept of “Law of Nature”: God and general law as legislator

The movement of the mechanical universe requires rules. Newton’s law of gravity is the peak of this idea. Its philosophical revolution is that it reveals a universal (universal), precise, mathematically expressible “law of nature” that equally governs the movement of celestial bodies and the motion of objects on the ground. As both Needham and Haff have emphasized, this notion of “law” (Law) is inextricably linked to the rational, transcendental image of “God” in the European monotheistic tradition, which legislates for the universe. Natural law is God’s “code” for nature, and the task of human scientists is to “discover” these sacred laws. This idea endowed the natural law with an external, compulsory, and undeniable authority, which greatly stimulated the scientists to find the unified and universal mathematical formula hidden behind the complicated phenomena.

3. The natural scene in Chinese traditional thought: The universe network of organic theory

In contrast to the picture of Europe in the 17th century, China’s dominant natural philosophy in the Ming and Qing

Dynasties was a profound organic and relational mode of thinking, whose origins can be traced back to Taoism and the theory of the five elements of Yin and Yang in the Pre-Qin Dynasty and refined in the Song and Ming Dynasties.

3.1. Organic theory and gasification universe: The life network of all matters

In China's mainstream philosophy, the universe is not a machine driven by external forces, but a living, self-generated giant organism. The basic substance/energy that makes up this organism is "Qi," a subtle substance with continuous, diffuse, psycho-physical dual properties. Everything, from stars to mountains and rivers, from the human body to emotion, is the expression form of "Qi" gathering and dispersing, and changing. Therefore, everything in the ontology is homologous and interrelated, forming an integral network. Understanding any part must be placed in its overall relationship rather than isolated for analysis ^[4].

3.2. Induction and resonance: The relevant thinking replaces linear causality

Under the guidance of organic cosmology, Chinese thinkers tend to interpret phenomena more in the form of "ganying" or "resonance" rather than seeking a single, linear causal chain. Just as in ancient times, the clock that struck one rhythm correctly and the clock that struck the same rhythm did not touch the self-ringing, everything in the universe was considered to be in a network of mutual inductive resonances. "Human-Heaven Sensing" is the most typical example, which holds that the anomaly of the sky echoes the political gain and loss of the earth. The meridian theory of traditional Chinese medicine also regards the human body as a small universe, and its viscera and qi, and blood communicate with each other and transmit information through the meridian network. This way of thinking is very good at grasping patterns, associations, and periodic changes in complex systems, but lacks the motivation and methodological support to separate variables and control experiments to explore precise causality ^[5].

3.3. Internal "Rationalism": A different concept of order from "Law of Nature"

Although Song and Ming Neo-Confucianism also put forward "Li" as the supreme principle of the universe, this "Li" and Newton's "Law" have an essential difference. China's "rationalism" is internal (immanent), which is the organizational pattern and development tendency of things themselves. It is not a command imposed by external authority, but an internal order that things follow spontaneously. Therefore, the goal of a saint or trait informant is to "comprehend" and "adapt" the doctrine to achieve harmony with the universe, rather than to "discover" and "apply" the external laws of nature, as Western scientists do. Joseph Needham pointed out keenly that the Chinese culture lacked a transcendent image of "God's legislator" and therefore failed to develop the concept of "natural law" as precise and universal as legal provisions ^[6].

4. Conclusion: Philosophical reflection on "Needham Problem"

Through the comparison above, we can clearly see that the scientific revolution in Europe in the 17th century is a special product of its unique philosophical soil. A cosmic picture dominated by mathematical, mechanization, and external universal law provides a necessary ontological and epistemological framework for the birth of modern physics. It encourages abstraction, quantification, reduction, and perseverance in linear causality.

China's traditional view of organic cosmology leads to a completely different knowledge system. It emphasizes concreteness, entirety, relevance, and dynamic balance. It has made brilliant achievements in medicine, ecology, agronomy, and the strategy of governing the country. However, this thinking paradigm is just contrary to the analytical and reductive methods required by modern science.

So perhaps the key to answering the Needham puzzle is not to judge the pros and cons of the two civilizations, or to regret what China has "missed," but to acknowledge that they follow two fundamentally different and logically self-consistent knowledge paths. Modern science is not the only or ultimate form of human rationality, but an extremely powerful tool for understanding and manipulating the material world under specific philosophical assumptions. China's

world of thought breeds another equally profound, but different-purported wisdom. Admitting this difference may be the fairest answer to the Needham puzzle.

Disclosure statement

The author declares no conflict of interest.

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