

On the Historiographical Reform of General History of Chinese Science and Technology in the Post-Needham Era

Liu Shengli*

Abstract: The research of General History of Chinese Science and Technology (GHCST) has so far failed to transcend the “positivist history”, a program of historiography initiated by Joseph Needham. The historians after Needham have made important explorations on the historiographical reform of GHCST. However, nearly all of these explorations are still the methodological reflections of the positivist history perspective, failing to reflect metaphysically on such historiographical presuppositions as views of science, technology and history, which means they have failed to break away from the positivist history perspective. To go beyond the limitations of positivist history calls for the introduction of the perspective of phenomenology of body and reflecting on and criticizing the historiographical presuppositions of positivist history on a metaphysical level. Such reflection will lead us to a new program of historiography in the post-Needham era, that is “phenomenal history” or the GHCST from the perspective of the phenomenology of body.

Keywords: GHCST; J. Needham; program of historiography; positivist history; phenomenal history

Historiographical reflections on GHCST are often closely associated with Needham^[1]. His multi-volume *Science and Civilization in China*^[2] initiated the positivist history historiographical program of GHCST, marking the beginning

* Liu Shengli, assistant professor, Research Institute of Philosophy and Culture, Sichuan Academy of Social Sciences.

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of a new era in the research of GHCST. From the perspective of the historiography, the research of GHCST has not gone beyond the academic era and historiographical paradigm represented by Needham. The research of GHCST in the recent decades has been largely the comprehending and inheriting of his work.^[3] However, as the consciousness of historiography awakens, researchers are starting to reflect on the positivist history program of Needham. This lays the groundwork for us to ponder the direction the historiographical reform of GHCST should take.

This paper intends to first reflect on the achievements and limitations of Needham historiographical program, and on that basis, preliminarily probe the reform direction of the historiography of GHCST. We will first briefly summarize the historiographical achievements and limitations of Needham's *Science and Civilization in China*, then expound on the previous efforts to transcend Needham's program and their limitations, and then argue the necessity of introducing the phenomenological perspective through philosophical reflections on the views of science, technology and history. The paper proposes that the perspective of phenomenology of body should be introduced to construct a new historiographical program of GHCST in the post Needham era.

1. *Science and Civilization in China* and Its Historiographical Achievements

Needham and his co-authors began publishing the multi-volume *Science and Civilization in China* in 1954. This voluminous work represents a masterwork in the 20th century research on GHCST. Even if seen only from the historiographical perspective, it has made extremely important achievements.

First, it is the first authoritative general history of Chinese science and technology in the 20th century, a pioneering work that paved the way for later studies. Prior to this, certain pioneers in history of Chinese science and technology had compiled histories on specific disciplines,^[4] but these studies did not draw the attention of the international academic community, and the researchers did not move into the field of general history. Although *Science and Civilization in China* was initiated by Needham, who was also the chief writer, the book is in fact the combination of the wisdom of dozens of western sinologists and experts in the history of Chinese science and technology. Joseph Needham and his team synthesized the contemporary research results for the first time, and thus created the general history paradigm in the research of history of Chinese science and technology.

Second, it is a positivist science and technology history that proves the case for the greatness of China's achievements in science, technology and civilization. Prior to Needham, the impact of the research on ancient Chinese science and technology achievements is trivial and minimal in the Western world. Western scholars, represented by Whitehead, spoke highly of Chinese civilization and the Chinese people's individual research gifts, however, they held that the Chinese people did not have their own indigenous scientific tradition.^[5] Taking advantage of his special identity of both being a member of the Royal Society and an internationally renowned biochemist, Needham initiated the compilation of the masterpiece *Science and Civilization in China*, making an extraordinary contribution in promoting the civilization of Chinese science and technology that could not be matched by any Chinese scholar. During decades of research on the history of Chinese science and technology, Needham acquired a large collection of ancient Chinese literature, pictures and historical materials, and made on-the-

spot investigations of some of the production and living traditions of Chinese science and technology. He even conducted a number of simulation experiments and technology restoration studies. He used extensive historical data and evidence to prove to the world that China does have a scientific tradition. He took the following strategy in making his case; first to distinguish “pre-modern science” from “modern science”, then to hold that the ancient Chinese science belongs to the “pre-modern science” tradition. This scientific tradition has a wealth of ancient philosophy and medieval techniques, and even has various theories of medieval nature. What is lacking in this tradition is the modern science that takes the mathematical form and can be tested through rigorous experiments. In short, Needham's positivist history gave high praise to China's science and technology achievements before the 16th century, even overstating the achievements in some cases where sufficient evidence is absent.^[6] Because this work was published in the 1950s, a period when China was isolated from the international community, the Chinese people felt particularly grateful toward Needham for his efforts to give the ancient Chinese science and technology the attention it deserves. “To prove the greatness of the achievements of Chinese science and technology” has since then naturally become the historiographical objective among historians in Chinese science and technology, an objective that they voluntarily carry forward and develop.

Also, Needham's work is a history of Chinese science and technology that is based on a China-Western comparative perspective. To identify the

substantive contributions of ancient Chinese science and technology to modern science, and also to determine the specific date and priority of scientific and technological discoveries and inventions, Needham put Chinese and Western science and technology traditions in contrast, using his famous “Titration” method. This makes the exchange and comparison of Eastern and Western civilizations a major thread running through the entire *Science and Civilization in China*.^[7] This historiographical tendency of China-Western comparative history has also been inherited and continued by historians in Chinese science and technology.

The historiographical paradigm initiated by *Science and Civilization in China* has had an important demonstration effect on the studies of history of Chinese science and technology. Since Needham, representative works of GHCST, regardless of the differences in compilation size and work length^①, universally take the promoting of ancient Chinese science and technology achievements as the historiographical objective, lay out ancient China's scientific and technological achievements from a modern science standpoint, and follow the historiography program of Needham consciously or unconsciously in terms of the historiographical approach. The general history of science and technology thus compiled can be a simple patchwork of division histories. This also underlines that the GHCST studies in China are stuck in the Needham era, and are adversely affected and bound by the positivist history historiographical program he created.^[3]

① The representative work of small-scale general history of science and technology is the single-volume general history compiled by Du Shiran and others in 1980s, and amended and republished in 2012. See Du Shiran, et. *History of Chinese Science and Technology* (M). Beijing: Peking University Press, 2012. The representative work of large-scale general history of science and technology is the 30-volume History of Chinese Science and Technology launched in 1990s and completed in 2008, with the participation of science and technology history researchers from around the country who were called on by Chinese Academy of Sciences, and its chief editor being Lu Jiaxi. Although the latter is supported by large amount of historical material and has done more specific and detailed researches, it achieves no fundamental breakthrough in historiographical programme.

2. Historiographical Limitations of the Positivist History Program

Although Needham's *Science and Civilization in China* indeed represents the pinnacle of the studies of the history of Chinese science and technology, the progress in the historiographical studies of Chinese science and technology reveals and exposes the limitations of the positivist history historiographical program.

2.1 Limitations of Whig History

Although Needham deemed that prior to the 16th century, "Chinese civilization was far more effective in acquiring natural knowledge and applying it to the practical needs of people than Western civilization,"^[8] he nevertheless believed that modern science would be the final destination for the development of scientific and technological traditions all over the world. He regarded the ancient Chinese science and technology as the pioneer of modern science, emphasizing that the former contributed to and promoted the development of the latter. He wrote the history of ancient Chinese science and technology into a history of progress and contribution that moves inevitably towards modern science and adds to its development, which means that Needham's work is a typical Whig history.

Whig history proceeds from the current vision and standpoint, and portrays history as progress toward today's goal with a strong historical teleological tendency. However, the fact is people historically have put forward their respective solutions addressing the specific problems of each era. They do not know the actual situation of today, and thus cannot establish it as a developmental goal. Whig history lays too much emphasis on the present. By reconstructing the past from the standpoint of the present it in effect ignores the past, as well as history in its true sense. Therefore, in recent decades, the

Western historians in science and technology have been actively promoting the reform of historiography, endeavoring to break away from Whig history and return to the specific historical context to the maximum extent possible. However, the studies of history of Chinese science and technology started relatively late, and thus failed to reach the stage of adopting diverse historiographical programs. Consequently, among the historians in Chinese science and technology, some are exploring new historiographical programs and adopting new historiographical practices, but overall, the studies of history of Chinese science and technology are still bound by the limitations and outlook of Whig history.

2.2 Limitations of Positivist Views of Science and Technology

Science and Civilization in China looks at the history of ancient China's science and technology from the viewpoint of 20th century Western science development. It uses the discipline patterns and demarcation criteria of science (verifiability of observation and experience) of the Western world in the 20th century to orchestrate historical data on ancient China's science and technology, making it a typical positivist history of science and technology. In regard to the history of world science and technology, "Needham's favorite metaphor is that many streams of traditional science converge into the ocean of modern general science."^[6] The "all rivers flow to the sea" model for science development, conveyed by this hydraulic metaphor, is entirely dependent on Needham's understanding and description of the characteristics of the Western modern science ideal. Researchers have analyzed this understanding in detail.^[9] Needham believed that modern science uses the universal mathematical language to describe a unique, real and objective natural world. Therefore, the knowledge is objective, uniform, universally valid, and cross-culturally

confirmable. No matter where they are originally found, they in principle are applicable to any other place. Such universal science in the world are in fact a kind of science that is detached from specific spatial-temporal limits and exists in the form of general knowledge. This monistic, essentialist and universalist view of Science is closely related to the education of positivist philosophy that Needham received. The view holds that science is not only continuous, but also accumulates and develops over the long term. This is the philosophy of science underlying Needham's "all rivers flow to the sea" model. However, after the 1960s, as the historical school of the philosophy of science represented by Thomas S. Kuhn developed, the above-mentioned model became increasingly implausible. Most historians in science and technology no longer believe in the monistic, essentialist view of science, and instead attempt to accept the pluralistic, anti-essentialist view.

2.3 Dual Limitations of Western Centrism and China Centrist

Seen from the surface of his research tendency, Needham is first of all a China centrist. He carried out his research to take advantage of the Western academic resources to defend China's achievements in ancient science, technology and civilization. In the absence of sufficient evidence, he even ventured to deliberately overstate China's achievements.

However, on the deep level of his research tendency, Needham is a Western centrist. Such Western centrism is mainly manifested in the following ways. Needham mainly accepted rigorous Western academic training early in his academic life. His views of science, technology and history and other historiographical presuppositions of the "positivist" program were constructed around the absolutely undoubted center of Western modern science: The target audience of his writings were

Westerners. Thus, from the perspective of a Western scholar, Needham strived to explore the part of China's science and technology civilization that can be appreciated by the modern Western science and technology civilization, rather than devoting himself to expounding the uniqueness of Chinese traditions in science and technology and putting the development process of China's science and technology in the historical context of ancient Chinese civilization.

For example, research on the compass and the "inner alchemy" are typical illustrations of the Western centrist tendency of Needham's positivist history. In Chinese culture's own historical context, the compass was originally invented to meet the needs of geomancy, and was only used for navigation much later. And the technology itself was not much of a revolutionary invention. Driven by the Western centrism, however, Needham put the research emphasis entirely on demonstrating the priority of the invention of the compass, its application to navigation and its magnetic achievements, strongly making the case for how the compass made a revolutionary contribution



The compass was originally invented to meet the needs of geomancy, and was only used for navigation much later.

to the birth and development of modern science through scientific transmission.^[3] Inner alchemy was originally a “science of Xing and Ming” developed by Taoism for pursuing the rule of longevity. Needham, however, gave his attention solely to the “Ming” part, while disregarding the “Xing” completely and failed to understand the inner alchemy in Taoism’s own context, but interpreted it through the context of western physiology, which abruptly distorted the inner alchemy into something more like “physiological alchemy”^[10].

Additionally, through his “all rivers flow to the sea” model, Needham presupposes that different and far flung traditions of science and technology are bound to eventually develop into modern science. Such a Western centrist presupposition is obviously wrong. Modern science is a fruit that was entirely created by the Western civilization. Without the force intrusions and interference from Western civilization, Chinese civilization was unlikely to give birth to modern science on its own. The modern history of Chinese science and technology has clearly shown that modern Chinese people did not so much redirect the development of traditional science and technology to the direction of Western science as simply abandon the traditional science and technology to learn and adopt modern Western science and technology. Chinese traditional science and technology and Western modern science and technology are of two entirely different traditions.

3. Historiographical Efforts to Go Beyond Needham’s Programme and Their Limitations

Recognizing these limitations in Needham’s program, sinologists (especially Needham’s collaborators) and historians in Chinese science and technology have made several new attempts,

trying to understand the history of Chinese science and technology anew by first elucidating the uniqueness of the tradition of Chinese science and technology and then going beyond his “positivist” historiographical program.

For example, regarding the efforts by Western sinologists the book, *The Way and the Word: Science and Medicine in Early China and Greece*,^[11] coauthored by N. Sivin, among Needham’s collaborators, and the British historian of science G. Lloyd, demonstrated Sivin’s historiographical program of “cultural history of science”, and researched ancient Chinese science and ancient Greek science from a Sino-Western comparative perspective. In this book, Sivin presented with the methodological notion of “cultural manifolds”, which tries to put science back into the specific situations contemporary to it, and research the integral cultural unity which is composed of the philosophical, social, technological, economic and political factors. F. Bray, another collaborator of Needham’s, demonstrated in her work, *Technology and Gender: Fabrics of Power in Late Imperial China*,^[12] the feminist history of science and technology, using the key concept of “clusters of technologies”.

Historians in science and technology from China also made valuable efforts in reforming the historiographical ideas and practice. For instance, Jiang Xiaoyuan, in his *Essence of Ancient Chinese Astronomy*,^[13] and other works, conducts sociological research on ancient Chinese astronomy and emphasizes its uniqueness relative to Western astronomy. Sun Xiaochun recommended that the “river scenery” model should take the place of Needham’s “all rivers flow to the sea” model, thereby advancing the study of the social and cultural history of ancient Chinese science and technology.^[14] These explorations are to some degree a leap from Needham’s positivist history program.

However, these explorations made by Wes-

tern sinologists and Chinese historians of science and technology merely sowed the seed for historiographical reform in the post-Needham era. These historiographical ideas are yet to be developed in depth and breadth, and yet to be implemented in the historiographical practice of GHCST. Additionally, these new historiographical explorations are still mostly methodological reflections on the positivist historiographical program, failing to conduct the metaphysical reflection on the views of science, technology, and history presupposed by the positivist historiographical program. It is precisely because of this that so far the community of history of science has not managed to compile a new representative work of GHCST through historiographical reform. For instance, Sivin's "cultural manifolds" represented the latest reflection on the methodology of GHCST, but he failed to acknowledge that the turn from positivist history to social-cultural history has not gone beyond the limitations of positivist history, because the latter still presupposes a metaphysical dogma of positivist history, "the strict dichotomy of nature and society", in historiography.^[15]

4. Philosophical Reflection on Views of Science, Technology and History

To go beyond Needham's historiographical program, it is necessary to conduct in-depth philosophical reflections on the views of science, technology and history presupposed by it, and to promote the reform of these views, to construct a new historiographical program in the post-Needham era based on new ideas and perspectives.

The reason why the existing explorations of historiography have failed to truly go beyond the limitations of the positivist history program lies largely in people having long failed to develop a

metaphysical reflection on, and critique of, Western modern science, and have so far held simple, objectified understanding of such concepts as science, technology and history, which is that they believe that these concepts have a sole, determined metaphysical essence.

First, this "objectified thinking" as reflected in the view of science has always led people to make an either-or choice between two views of science. One is the monistic, essentialist view of science which emphasizes the unity of science traditions, symbolizing a singular science. The other is the pluralistic, anti-essentialism view of science which emphasizes the diversity of science traditions, symbolizing plural sciences. After the 1960s, under the influence of Kuhn's historical school of philosophy of science, historians in Chinese science and technology no longer took for granted the monistic view of science presupposed by the positivist historiographical program, but instead began to accept the pluralistic view. However, if the pluralistic view of science turns into a truth, how should we understand the identity of sciences which, after all, can be referred to using the same concept of "science"? Should we not presuppose a universal sense of science to illustrate this identity? Therefore, we should not insist on an objectified view of science, because it will inevitably lead to the diametrical separation and reduction of the identity and differences in the view of science. Just like in the case of Needham's work, the science of the world, in the form of universal knowledge, is a symbol of identity, while science and technology of different traditions or from different countries symbolize the reduction of differences. A new view of science should not move from a dogmatic monism toward a dogmatic pluralism, but take into consideration a primordial synthesis of monism and pluralism, taking advantage of the genetic-phenomenological studies of the views of science to move toward a

“pre-objective” view of science.

Second, the objectified thinking reflected in the view of technology leads to a tool-oriented, objectified view of technology, as well as the separation and one-way reduction of science and technology. Needham did not specify a subtle philosophical distinction between science and technology, but rather hastily regarded technology as some kind of “applied science”, which, together with various forms of traditional science, is included among the ranks of “pre-science”. The “pre-sciences” constitute the hundreds of “streams” that flow into the sea of “universal science of the world”. Since this science of the world is a formalized, objectified science, the pre-objective nature of technology as a “pre-science” is not studied and reported. It is precisely for this reason that in *Science and Civilization in China*, Needham conducted relatively detailed studies of a variety of tool-oriented, objectified technologies, especially those associated with modern Western science, while giving relatively little regard to the typical modality of the pre-objective technology, such as the “body technique” that finds its place in a range of Chinese traditions, including Confucianism, Taoism and medical^①. This “body technique” proves the uniqueness of the Chinese traditions of science and technology. To probe into this technique, we must reveal a pre-objective view of technology through introducing phenomenological resources. In this pre-objective view, there is neither the dichotomy between cognitive form and content, nor that between theory and practice. Technology is no longer a vassal of the universalistic scientific form, but has its own unique value in fixing, interpreting, and expressing the meaning of primordial perceptual experience.

Finally, what this objectified thinking is reflecting in the view of history is the separation and one-way reduction of “present” and “past” within the historical framework. The extreme Whig history emphasizes the historical meaning of “present”, among the three time phases of “past, present and future”, presupposes the historical structure in which the meaning of past is dominated, determined and reconstructed by the meaning of present, thus prone to moving towards a realist history. Extreme “anti-Whig history” stresses the historical meaning of the “past,” among the three time phases, presupposes the historical structure in which “the meaning of the past determines the meaning of its own, and even that of the present,” which makes it incline towards an idealistic history. But again, how can the historical narrative completely rid itself of the present narrator and go back to the past? Therefore, neither the Whig history nor the anti-Whig history will do, as they will both lead to absurd historical studies. A new view of history should maintain a reflective equilibrium between the realist view and the idealistic view of history, thereby moving toward a pre-objective view of history.

Therefore, in order to transcend the positivist program of historiography, we need to make use of the theoretical perspective offered by the phenomenological traditions and introduce a pre-objective element to the views of science, technology and history within the new historiographical program, whose structure will imply a primordial synthesis of internality and externality and will not result in complete separation or one-way reduction. This synthesized structure will help to elucidate the unique unity of the tradition of Chinese science and technology.

^① These body techniques include: Confucian etiquette technique, worship technique, self-cultivation technique; Taoist sitting technique (Zuowang), guidance technique (Daoyin), food-taking technique (Fushi) and fasting technique (Pigu); TCM's pulse-taking technique, acupuncture, and health-preserving technique.

5. Toward a New Historiographical Program in the Post-Needham Era: Phenomenal History

Based on the pre-objective views of science, technology and history, we are truly enabled to overcome the limitations of Needham's historiographical program and construct a new program in the post-Needham era. GHCST from the perspective of the phenomenology body: "Phenomenal history".

This new program of historiography arose from Klein's pioneering research of combining phenomenology with the history of science.^[16] But Klein's work still falls under the scope of the intellectual history of science because the phenomenology it applies is mainly Husserl's phenomenology as transcendental idealism in his later period. By introducing Merleau-Ponty's phenomenology of body to modify Husserl's phenomenology of consciousness, we can render Klein's historiographical theory and practice into a new historiographical program needed for research of GHCST.

We will briefly outline the main historiographical characteristics of the "phenomenal history" in comparison with the positivist program of historiography.

5.1 Objective of Historiography

The historiographical objective of Needham's *Science and Civilization in China* is to first prove the greatness of Chinese achievements in science, technology and civilization, and then to answer the "Grand Question" of "why modern science did not come into existence in Chinese civilization" conceived by him from a socio-economic point of view. Nowadays, research of GHCST should not and has no need to prove the greatness of Chinese achievements and answer Needham's "Grand Question". The historiographical objective of the

phenomenal history will reveal the subjectivity or uniqueness of the tradition of Chinese science and technology within the inter-subjective structure of China-Western history of science and technology, and to rewrite GHCST based on this uniqueness.

5.2 Presuppositions of Historiographical Philosophy and Ideas

The positivist philosophy of science and technology in the first half of the 20th century provides the positivist history program with the philosophical basis of historiography. The idealistic presupposition of positivist history is primarily positivist views of science and technology and Whig views of history. The phenomenological philosophy of science and technology, evolving from the European continental phenomenological traditions, will form the philosophical basis for the "phenomenal history" program. The phenomenal history's idealistic presuppositions are primarily views of science, technology and history under the perspective of the phenomenology of body. The phenomenal history will conduct a comprehensive reflection on the dualist or reductionist metaphysical framework, for example, dualism presupposed by "internal history-external history", "intellectual history - social history", "realism - constructivism," "Whig history-contextual history", and other antitheses, from the perspective of the phenomenology of body, and advance new syntheses of studies on history of Chinese science and technology combining with the research on phenomenological philosophy of science and technology.

5.3 Historiographical Model: "Scenery at Both Riverbanks" Model

If the "all rivers flow to the sea" model characterizes the historiographical model of the positivist history program, we can draw on the insights provided by the historiographical reflections

of Sun Xiaochun,^[14] and present the historiographical model of the “phenomenal history” program as the “scenery at both river banks” model. However, the “river scenery” model recommended by Sun Xiaochun presupposes that the river is the “river of Chinese civilization of science and technology,” whereas the phenomenal history’s “scenery at both riverbanks” model is under the presupposition that the river is the “river of world civilization of science and technology” or the “river of human rational life”. The world’s two major traditions of science and technology, namely, Chinese tradition of science and technology and the Western one, constitute the two banks of the river.

5.4 Methodological Reform of the “Phenomenal History” Program

The methodological reform of the new historiographical program is mainly the introduction of “theme-horizon” or “form-background” dynamic, a holistic-analytical approach in the sense of the phenomenology of body. If a simple correspondence can be made, when the history of scientific thought conducts theme-based analyses of the development of concepts and theories, what it lacks is to consider the changes to the idealistic horizon, social horizon and other horizons at different levels, which make for the background, and its mutual constitution with the theme. When the social history of science proceeds theme-oriented analyses of the economic, political, social and cultural conditions of scientific development, what it lacks is to consider the requirement that these conditions must have internal connections with the development of concepts and theories to construct a more appropriate analysis of the history of science. The “phenomenal history” program will attempt, by means of the “theme-horizon” analytical method, to synthesize the two traditional historiographical programs, namely, intellectual history of science and social history of

science.

5.5 New Problematique of “Phenomenal History” Program

The new issues worthy of attention in future GHCST studies under the “phenomenal history” program include:

(1) Under the new view of science from the perspective of the phenomenology of body, how to understand the basic concepts in ancient Chinese science, such as *Qi*, *Yin and Yang*, *Wuxin* (*five elements*) and *unity of man and nature*? How to interpret these concepts from the bodily-phenomenological standpoint? How to understand the unique paradigm of ancient Chinese science defined by these basic concepts? What are the associations and differences between the theoretical and practical forms of this paradigm and those of Western modern science? Why was this paradigm abandoned after the introduction of modern Western science to China?

(2) Under the new view of technology, how to understand the nature and characteristics of the tradition of ancient Chinese technology? How are the above-mentioned basic concepts in ancient Chinese science to play a role in establishing and developing the tradition of ancient Chinese technology? What are the associations and differences between the tradition of ancient Chinese technology and that of ancient & modern Western technology? How to understand the importance of “body technique” in the tradition of ancient Chinese technology? Why does traditional Chinese medical technology persist in resisting modern Western medical technology, after all the other ancient Chinese technologies were replaced by modern Western technologies?

(3) Under the new view of history, how to divide periods in the general history of Chinese science and technology? In each period, how are the ancient Chinese sciences and technologies related to each

other, influence each other, and interact with each other? What are the associations and differences between this mode of interaction of Chinese science and technology and that of western science and technology?

Admittedly, this paper, composed from the perspective of historiographical philosophy, only manages to conduct a preliminary exploration into the theoretical possibility of constructing “phenomenal history” as the new historiographical

program of the GHCST. The historiographical studies of GHCST from the perspective of the phenomenology of body are bound to face various difficulties. But we are convinced that, once progress is made, the “phenomenal history” program will help studies of GHCST to break through the influence and constraints of the positivist history program, thus achieving a new historiographical synthesis.

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