



# Rethinking the Needham Question

A Non-Eurocentric Framework  
Transcending Dialogism

Raymond W. K. Lau



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*Dedicated to my deceased parents, and to all the scholars who  
in the past seven decades have contributed to the building of  
a non-Eurocentric case.*

## PREFACE

Up until fifteen months or so ago, it would never have occurred to me that I might be writing a book on the Needham Question (NQ). I was trained as a sociologist with a special interest in theoretical issues, but in the latter 2000s, I became interested in learning about ancient Chinese thoughts.<sup>1</sup> A substantial proportion of the literature concerned discusses ancient Chinese thoughts in comparison to Greece and Europe, hence, I was led into an investigation into ancient Greek thoughts as well. As is to be mentioned later on, it was my work on comparing ancient China with Greece that subsequently led me to the NQ.

As someone not trained in the fields of ancient Chinese thoughts, classical studies, or science history, is it not presumptuous of me to believe that I might have something new to say in these areas? To answer this question, I will have to beg the reader's indulgence and forbearance so I can explain the background that ultimately led to the writing of the present work.

On the occurrence of paradigmatic changes in the development of science, Kuhn (1996, p. 90) observes that 'Almost always the men who achieve these fundamental inventions of a new paradigm have either been very young or very new to the field whose paradigm they change'. Although I was familiar with Kuhn's work, these words of Kuhn's were never on my mind when I began in the latter 2000s what I took for granted

<sup>1</sup> Educated in colonial Hong Kong, under the colonial government's policy of sidelining the teaching of Chinese history and culture in primary and secondary schools, like the vast majority of our and subsequent generations, my knowledge in these areas was then minimal.

to be a purely learning journey—and it goes without saying that not every outsider entering a new field would be able to make new contributions to it. However, almost right from the beginning, I was taken by surprise by the prevalence, in both the Chinese-language and the English-language literature, of essentialist analyses of various types<sup>2</sup> in the comparison between China and Greece/Europe. In my theoretical training as a sociologist, I had come to regard essentialism with great scepticism, hence I was convinced that these analyses must have been mistaken. This was the first time that it occurred to me that I might not simply be learning in a wholly passive way.

Then, when I came to read the philosophers Laozi, Zhuangzi, and Xunzi of the pre-Qin period (i.e. before –221 when the Qin Dynasty was founded) in the original texts, I found that my knowledge and experience as an outsider coming to a new field were of tremendous help in the interpretation of several key issues of their philosophies. Let me illustrate with a case concerning Zhuangzi (ca. -369 to –286), selected from several similar cases because it is especially dramatic.

As a sociologist, I was much attracted by the concept of *habitus* put forward by the French sociologist Pierre Bourdieu. This concept is derived from the phenomenology of the French philosopher Maurice Merleau-Ponty, one of whose major concerns was with the dispositional in human actions. The dispositional refers to that which is non-cognitive, and, as illustrations, Merleau-Ponty referred to various skills-based activities. As a student of Chinese calligraphy and practitioner of several skills-based sports, I could quite readily come to grips with Merleau-Ponty's notion. All this was before I became interested in ancient Chinese thoughts. Zhuangzi and his disciples were fond of making use of parables, and of these parables there are a dozen or so concerned with consummate craftsmanship. Zhuangzi experts have advanced several different interpretations of these parables and their role in Zhuangzi's overall philosophy, such as one, advanced by several leading sinologists, that sees Zhuangzi as referring to the daemonic, an interpretation that I found, to put it bluntly, particularly absurd. With my previous knowledge of the notion of the dispositional, I had little problem in understanding that Zhuangzi was saying that the relationship between the consummate calligrapher's hand (to use calligraphy as illustration) and the brush, the scroll, and the ink is

<sup>2</sup> See Chap. 2 for a detailed analysis of essentialism and its various types.

dispositional and non-cognitive in nature. What, then, is the role of the notion of the dispositional in Zhuangzi's philosophy?

Before I came to read Zhuangzi, I had been a scuba diver for many years. One of the greatest joys that I derived from diving was the following. Beneath the water surface, there was absolute quietness, the only sound that existed was one's own breathing, there was no need for words, and because of which, one was no different from the fish and corals around. This gave me a sublimely serene feeling of being one with nature. In one well-known statement, Zhuangzi states: 'Heaven and earth<sup>3</sup> co-exist with me, and the myriad things are one with me. Since [all] are one, is there any need for words?'. The phrase 'one with me' has been given various interpretations, such as the one which argues that 'one' refers to the primal chaos. However, Zhuangzi's meaning was crystal clear to me. As explained, the theme of the craft parables concerns the notion of the dispositional, which refers to that which is non-cognitive. Despite possessing one of the most perceptive minds that humanity ever had, Zhuangzi ironically longed to rise above the cognitive and to relate to nature without the need for words and, hence, thinking, just as in the case of the scuba diver or the consummate craftsman. More than two millennia before anyone suspected the existence of environmental issues, Zhuangzi was already laying down the most thoroughgoing environmental philosophy that the world has yet to catch up with.<sup>4</sup>

By the late 2010s, I felt myself to be reasonably well-grounded to put pen to paper on a comparison between intellectual developments in Greece and ancient China. This was published in 2020 under the title of *Intellectual Developments in Greece and China: Contingency, Institutionalization and Path Dependency* (Lau 2020), in which comparisons are made in the areas of natural philosophy, logical and abstract thinking, approach to the study of nature, mathematics, astronomy, and so on. The subtitle refers to a specially constructed theoretical-methodological framework, to be discussed presently, that underpins my comparison.

In the above, I have explained how my own background as an outsider to the field of ancient Chinese thoughts enabled me to bring some new

<sup>3</sup>The phrase 'heaven [meaning the physical sky] and earth' means the natural world.

<sup>4</sup>My interpretations of the parables and their role in Zhuangzi's philosophy, and of his statement 'Heaven and earth...' have since been published in two peer-reviewed journal articles, firstly, in a Chinese-language version (Lau 2019), and then, in an English version in *Asian Philosophy* (Lau 2021).

ideas to that field that have proven to be of value. Did anything similar occur in my comparison between Greece and China? Over the long process of my empirical research that lasted more than a decade, I came to realize that various observations that I was able to make could best be understood or made sense of by means of certain theories, concepts, and insights from a number of disciplines, including historical sociology, physics, the philosophy of science, evolutionary theory, neo-institutionalist theory, and so on. It will be noted that all of these disciplines, with the partial exception of the philosophy of science, are unrelated to both classical studies and the study of ancient Chinese thoughts. I put the just-mentioned theories, concepts, and insights plus some of my own observations together to construct a single, integrated theoretical-methodological framework that I believed to be useful for analysing intellectual developments, whether of a particular civilization or in a comparative context. This framework enabled the drawing of some unexpected conclusions. The following is one illustration.

Greece's atomic theory, the crown jewel of Greek natural philosophy, is often taken to be proof of the Greeks' purportedly 'unique' ability to engage in abstract and logical thinking. With reference to several components of my above-mentioned theoretical-methodological framework, I show, however, that that is a myth; instead, the theory was a contingent unforeseen outcome of a long non-deterministic process. This process began with a contingent synthesis of mystical thinking and the peculiarity of the Greek copula on the part of Parmenides, for whom the empirical was illusory, while the non-empirical was understood in largely mystical terms. During this process, a couple of conceptual errors were committed by Parmenides and Zeno (a very elementary one in the case of Parmenides), errors that Democritus took up lock, stock, and barrel, and which were indispensable to the formulation of his theory. In my framework, I call something that, on some particular criterion (such as rationality), is originally negative (positive) but which subsequently turns out to serve positive (negative) purposes, an irony of history, which, as something unforeseen, is contingent in nature. Given the semi-mystical origins of the above process, and the indispensability of Democritus' sharing of Parmenides' and Zeno's conceptual errors, the coming up of the atomic theory precisely constituted such an irony of history, as that theory was eventually to constitute the conceptual basis upon which Descartes engaged in his rational mathematization of nature. Contingency constitutes a core, systematically analysable component of my framework, while

unforeseen consequence and irony of history constitute key concepts that enable the making sense of many historical developments, including intellectual developments, in a non-essentialist way, as in the case of Greece's atomic theory.<sup>5</sup>

After completing my book, I suggested in the 'Concluding Remarks' that my theoretical-methodological framework could also be useful for analysing the NQ, but, for various reasons, I did not then intend to go on to research into the NQ. However, my book subsequently came to the attention of some members of the Needham Research Institute and the science historian Arun Bala, a leading advocate of the non-Eurocentric dialogical perspective (or dialogism for short) on the NQ, and discussions with them followed. Of particular importance was my rewarding dialogue with Bala that continued throughout 2021 and 2022. Sometime during our dialogue, we explored the possibility of convening an international conference on the NQ. Eventually, a conference titled 'Needham's Dialogical Vision: Understanding Science as a Multi-Civilizational Outcome' was held at the Hong Kong University of Science and Technology (HKUST) on 23–24 March 2023.<sup>6</sup>

For that conference, I prepared a paper titled 'Revisiting the Needham Question: Beyond transmission in critiquing Eurocentrism', which provided a first, preliminary formulation of the argument of the present book. At that time, I already sensed the need to transcend the dialogical perspective, because it suffers from certain fundamental limitations (see shortly

<sup>5</sup>In my book, besides the atomic theory, I provide numerous other cases of such unforeseen consequences and ironies of history in relation to both Greece and China. Incidentally, in relation to the atomic theory, it is worth pointing out that contrary to the common claim, as mentioned, that the Greeks were 'uniquely' capable of engaging in abstract thinking, in Greek natural philosophy, the various *arché* substances proposed by the Milesians (Thales, Anaximander, and Anaximenes), Empedocles, Anaxagoras, and Aristotle (water for Thales, and so on) are all based upon empirical, not abstract, concepts (see note 14 of Chap. 5); Plato's notion of divine Forms constitutes an abstract concept, but it is largely a religious notion; only the atomic theory is based upon an abstract concept, but, as just explained, it was a contingent unforeseen outcome with semi-mystical origins. If one compares and contrasts this with how ancient Chinese thinkers conceptualized the ultimate constituents of empirical things (see Sects. 5.3 and 5.4 of Chap. 5), one would realize that the received wisdom in this regard is exactly the reverse of reality.

<sup>6</sup>The conference was organized by The Joseph Needham Foundation for Science & Civilization (Hong Kong) and the Needham Research Institute (Cambridge), jointly with HKUST, the Faculty of Asian and Middle Eastern Studies of the University of Cambridge, and the Jao Tsung-I Petite Ecole of the University of Hong Kong.

below). However, I wanted to state my position in a more restrained manner, hence, I spoke of ‘transmissionism’ (meaning focusing solely on the indispensability of knowledge transmissions from non-European civilizations into Latin Europe in the making of modern science) instead of dialogism as such, vaguely leaving room for the possibility of some form of the dialogical position that does not fall into the trap of transmissionism. However, after the conference and further exchanges with Bala, I came to the conclusion that there is no such room as just mentioned that exists, because dialogism’s limitations are theoretical and methodological in nature, hence the necessity to point this out in clear terms and call unambiguously for dialogism’s transcension.<sup>7</sup> It was then that I made the decision to write the present work.

The same question as mentioned in the second paragraph above needs to be raised again: As a non-science historian, can I claim to have any new contributions to make to the study of the NQ? At the risk of being ridiculed by expert science historians, I believe that, indeed, I can, and that, again, is due precisely to knowledges derived from other disciplinary areas that, as an outsider to the history of science, I am familiar with. To refer to just one example that also concerns the theoretical-methodological framework that I had constructed in my comparison between Greece and China, as a result of my investigation into the NQ, this framework has been refined and further developed. Almost all the components of this framework are derived from non-science history disciplines. Among these components, there are two that I want to highlight in the present context to illustrate the point that I am presently making. These two components are scholarly tradition, analysed with reference to neo-institutionalist theory in organizational sociology and path-dependency theory which was initially formulated in institutionalist economics, and scholarly agency, which is my own application of the sociological concept of agency to the scholarly context. Both scholarly tradition and scholarly agency constitute explanatory variables that, as analysed from the perspectives of the just-mentioned theories and concepts, can be made subject to non-essentialist accounts. To date, that these variables need not, at all, be interpreted essentialistically has not been understood by either Eurocentric or non-Eurocentric (dialogical) scholars in the debate on the NQ. Instead, both camps alike believe, mistakenly, that arguments that make reference to

<sup>7</sup>By transcension, I mean going beyond, not supplanting or abandoning. This will be explained in detail in the Introduction.

scholarly tradition and what I refer to as scholarly agency are necessarily essentialist. This is why scholars of the latter camp invariably shy away from these two variables, which is one important factor responsible for dialogism's intrinsic limitations as a perspective.

So much for the background to, and my justification for, the writing of the present book as a non-science historian. It must be stressed that while I do believe that my outsider background is instrumental to formulating the argument of the present work, no claim is made that anything like paradigmatic change is intended or involved. I can recall that the first time I submitted a paper to a Chinese-language China Studies journal on ancient Chinese philosophy, I encountered stiff resistance to the extent that even my writing style<sup>8</sup> was faulted by one of the referees who could obviously tell that I was an outsider from my writing style alone. A veteran neo-Confucian (see note 8) scholar who had read my manuscript beforehand and liked it told me afterwards that that journal, while being top in the field, was a bastion of extreme conservatism. I have much greater confidence in the openness of the contemporary field of science history, though whether or not my efforts are of any value is, of course, in the hands of the readers.

I would like to end by expressing my deepest gratitude to Arun Bala for his extensive exchanges with me throughout the process of my investigation into the NQ up to the present day. The argument of the present work was first formulated in a provisional way in a paper that I delivered at the previously mentioned 'Needham's Dialogical Vision: Understanding Science as a Multi-Civilizational Outcome' conference held in Hong Kong in March 2023; and an outline of the full development of my argument was presented at the 'Circulating Knowledge: 20 Years On. Research, Translation, Pedagogy' conference held in Halifax in August 2024. I have much benefited from exchanges with, among others, Keekok Lee, John Steele, Roger Hart, Prasanjit Duara, Mei Jianjun, Christian Daniels, Bill M. Mak, Tung-yi Kho, Hyunhee Park, Gordon McQuat, Robin Yates, Fa-ti Fan, and Anna Winterbottom, either during the preparation for or at those two conferences. I would also like to thank the anonymous referees for their very constructive and thought-provoking comments. Marion

<sup>8</sup>Trained in the British abstract theoretical academic tradition, I acquired its writing style, and though I was writing in Chinese, the way I wrote under the influence of that style was at odds with that practised by scholars nurtured in the century-old modern neo-Confucian tradition to which that journal belonged.

Duval and others at Palgrave Macmillan have been wonderful partners to work with. Last but not least, a special word of thanks is due to Dr. Peter Lee, a close friend and associate of Joseph Needham before the latter passed away, and incumbent chair of The Joseph Needham Foundation for Science & Civilization (Hong Kong), for his support over the past several years.

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## Introduction

One manuscript reviewer of the present work has noted that whereas it is primarily addressed to scholars directly engaged with the Needham Question (NQ), it is of relevance to a much wider circle of scholars who are concerned with the issues of Eurocentrism and non-Eurocentrism in one way or another. We think that there are two reasons why this is so. Firstly, the present work's substantive historical analysis in relation to the NQ is underpinned by a specially designed theoretical-methodological framework for analysing intellectual development (extending in various ways to historical development generally) on a non-essentialist basis. The relevance of such a framework extends well beyond the NQ. Secondly, and relatedly, in the literature on the NQ, there is a lot of confusion, among both Eurocentric and non-Eurocentric scholars alike, concerning what essentialism and its critique precisely involve and entail in historical analysis, as a result, we often find Eurocentric scholars assuming that certain types of explanation are 'by nature' supportive of their position, while non-Eurocentric scholars, who share the same confusion, reject those types of explanation on principle thereby losing much potential, non-essentialist explanatory capability. There is, however, no reason why any particular type of explanation is necessarily essentialist, it is how any specific argument belonging to that type is conceived and argued that determines whether or not it constitutes an essentialist argument. Again, in clarifying such confusion, the present work's relevance extends beyond the

NQ. Hence, whereas scholars directly engaged with the NQ constitute our primary target, the present work is not restricted to them.

Returning to the substance of the present work, it is not an attempt to provide a full analysis of the rise of modern science, the subject matter of the NQ. Rather, its objective is *methodological*. Chapters 2 and 3 are methodological chapters, Chap. 2 defines the problem and its various aspects for our investigation, Chap. 3 presents our theoretical-methodological framework for analysing intellectual development including the rise of modern science on a non-essentialist basis, and the scope of the following chapters is confined to illustrating the points made in the second chapter, and applying the theoretical-methodological framework laid down in the third.

The NQ is a dual question, incorporating a positive one ('Why had modern science arisen in Europe?', hereinafter positive NQ) and a negative one ('Why had it not arisen elsewhere?', hereinafter negative NQ). The late Angus Graham, the pre-eminent English-language sinologist of modern times, perceptively pointed out that both the negative question and the dual nature of the NQ are conceptually problematic (Graham 1973). In Chap. 2, we explain what this conceptual flaw is, and show that Needham committed it because he remained very much under the influence of Eurocentrism. This becomes especially clear from our examination of the Eurocentric position in its original form with reference to Max Weber, in which it can be seen that Needham's raising of the NQ in dual form was in complete accord with Weber's conceptualization. We define Eurocentrism and essentialism precisely, and analyse essentialism into three varieties, namely, bio-psychological, social, and cultural. With bio-psychological essentialism no longer defended today, at least not openly, Eurocentric arguments take either the social-essentialist or cultural-essentialist forms. In critiquing essentialism, there is often confusion with regards to social and, particularly, cultural explanations. Such explanations need not necessarily be essentialist in nature, if and when the factors concerned can be accounted for on a non-essentialist basis, they constitute legitimate explanations. Though remaining under the heavy influence of Eurocentrism, Needham, on the other hand, called for abandoning it by arguing that Europe had benefited substantially from various transmissions of scientific (in addition to technological) knowledges from China. This was a seminal call that justifiably earned Needham his reputation.

Because both the negative NQ and the dual form in which Needham raised the NQ are conceptually flawed, our focus is on the positive

NQ. Nonetheless, given the fact that, like Needham, Eurocentric scholars invariably raise the NQ in dual form, hence, in critiquing their arguments concerning the positive NQ, it is impossible to avoid critiquing at the same time their arguments concerning the negative NQ, since these latter arguments are meant to support and complement their arguments concerning the positive NQ. As we are more familiar with China, in doing so, we restrict ourselves to its case. Hence, in some of the following chapters and in the appendix, detailed discussions on China will feature on various occasions. It should, however, be noted that our critique contained in these discussions is not meant to address, and does not constitute an analysis of, the negative NQ.

Thanks largely, though far from exclusively, to Needham's efforts in carrying out his above-mentioned seminal call, there gradually emerged a non-Eurocentric position in the study of science generally and the rise of modern science in particular known as the dialogical perspective or dialogism for short. Dialogism argues that it was through the cross-fertilizations of knowledges between different civilizations that science, including the rise of modern science, developed.<sup>1</sup> By the 2000s, a relatively strong case for dialogism with regard to the rise of modern science had been established. Under its challenge, Eurocentric scholars have responded in two ways, either singly or in combination. The first type of response tries to minimize the extent to which Europe had benefited from knowledge transmissions from non-European civilizations; the second type resorts to neo-Eurocentric arguments. The first type takes either or both of two forms, one is to adopt a legal definition of evidence concerning knowledge transmission, in accordance with which many knowledge-transmission claims can be dismissed out of hand without further ado; the other is to make the cultural-essentialist claim that there are 'cultural obstacles' to

<sup>1</sup>The term 'dialogue' was first used by Arun Bala in the title of his 2006 book. Bala has informed us in private communication that he, in turn, has borrowed the term from the title of Needham 1969. This term can be misleading in that it may be taken to imply conscious intention on the part of the parties concerned to engage in dialogue. In our understanding, Bala uses the term to simply refer to knowledge transmissions in the course of contacts between different civilizations that led to intellectual cross-fertilizations, without any necessary implication of the existence of a conscious intention to discuss with one another between individual scholars on the transmitting end and individual scholars on the receiving end of such transmissions. Upon our enquiry with him in private communication, Bala has confirmed that our understanding is correct. Despite the term's potential to mislead, we stick to it as it has become part of the lexicon concerning the NQ.

knowledge transmission. It should be noted that in both of these forms, the first type of response remains within the parameters of conventional Eurocentrism.

In neo-Eurocentric arguments, the role of knowledge inputs from non-European civilizations is, to varying degrees, acknowledged, hence the claim is no longer made, as it is in conventional Eurocentric arguments, that science was all along Europe's 'autochthonous' development, but it is argued that Europe was able to make use of non-European inputs to breakthrough into modern science as a result of certain 'unique' European 'qualities'. In speaking of 'qualities', most neo-Eurocentric arguments take the form of cultural essentialism. It is clear that although it is useful to refer to such arguments as neo-Eurocentric, there is actually very little that is 'new' in them; the only 'newness' consists in their application of conventional cultural-essentialist arguments but restricting that application to the period of the breakthrough into modern science.

Faced with the above responses, dialogism has, on the one hand, not directly tackled the responses that remain within the parameters of conventional Eurocentrism; and, on the other hand, it has been unable to provide any effective counter-argument against the neo-Eurocentric challenge. As the critic of Eurocentrism and neo-Eurocentrism in relation to the rise of capitalist modernity John Hobson once remarked to the leading advocate of dialogism Arun Bala, neo-Eurocentrism has 'stolen the thunder' from dialogism,<sup>2</sup> and Bala has admitted as much to us in private communication (see presently below).

Why has dialogism failed to rise to the above challenges? This has everything to do with the very *theoretical and methodological nature* of dialogism itself. Dialogism is solely concerned with showing the extent to which Europe had learnt from non-European civilizations, but it does not engage in any analysis of the phenomenon of intellectual development itself; that is why when asked by us the question of why, based on what Europe had learnt from non-European civilizations, it was able to make the breakthrough into modern science itself, Bala had to admit that this remains a 'black box'. It is for this very reason that dialogism has not been able to respond to the neo-Eurocentric challenge. Furthermore, in relation to conventional Eurocentric arguments, dialogism has never taken the bull by the horns, i.e. it has never offered any direct rebuttal of specific social-essentialist and cultural-essentialist arguments, these arguments are

<sup>2</sup> Private communication to us from Arun Bala.

simply bypassed. This is why not only has dialogism not been able to respond to the neo-Eurocentric challenge, it has also not tackled the above-mentioned Eurocentric responses to the challenge of dialogism that remain within the parameters of conventional Eurocentrism. The reason why dialogism has never tackled specific social-essentialist and cultural-essentialist arguments is that, like Eurocentric scholars, supporters of dialogism also believe, mistakenly, that the factors resorted to by Eurocentric scholars, such as cultural values, etc., can only be accounted for on an essentialist basis.

The above shows that as a perspective, dialogism suffers from *intrinsic* limitations, and hence needs to be *transcended*. By transcend, we mean *to go beyond, not supplanting or abandoning*. What this means is that we accept the merits of dialogism (demonstrating the indispensability of various knowledge transmissions into Europe from non-European sources in the making of modern science) as a valid and important starting point in the construction of a non-Eurocentric analysis, but argue that in order to satisfactorily resolve the positive NQ on a non-essentialist basis and decisively rebut both Eurocentrism and neo-Eurocentrism, it is necessary to go beyond dialogism in theoretical and methodological terms. To achieve this transcension, what is required is to address what dialogism precisely fails to do, namely, to provide an analysis of the phenomenon of intellectual development itself, i.e. to account for intellectual development including the rise of modern science on a non-essentialist basis.<sup>3</sup> To do this, we propose a specially designed theoretical-methodological framework, first formulated in an earlier project of ours (Lau 2020) and further developed for the present work.

Our framework draws upon theories, concepts, and insights from a variety of disciplines including historical sociology, philosophy of science, physics, evolutionary theory, organizational sociology, and so on, which, together with our own views, are synthesized into a particular approach. Our framework comprises the following components: (a) Sensitive dependence of historical development on starting point; (b) contingency in history as a systematically analysable explanatory variable; (c) the synthesis of

<sup>3</sup>One manuscript reviewer of the present work, noting dialogism's failure to respond to the neo-Eurocentric challenge and our ability to fill this gap, has suggested the term 'neo-dialogical' to us as the counter to 'neo-Eurocentric'. We are most grateful to this reviewer for her/his imaginative and tantalizing suggestion and have considered it carefully; however, we have not taken it up since our transcension of dialogism goes well beyond any 'neo-' refinement of it.

externalist and internalist explanations; (d) scholarly tradition as a self-reinforcing informal institution that can be made subject to non-essentialist analysis; (e) the distinction and relationship between the formal aspects and substantive knowledges of a scholarly tradition; (f) historical development as a path-dependent process; (g) process approach versus mechanistic approach; (h) the internal factor of scholarly agency as a non-essentialist explanatory variable.

While it is impossible to provide in this Introduction even a brief explanation of these elements and of how they are combined into our approach, a few points can be highlighted here to provide a preview, as it were. Firstly, with regard to (a) above, given the role of the Greek tradition in the rise of modern science, in explaining our approach in Chap. 3, we briefly touch upon the issue of how and why the Greeks came to establish their particular tradition, an issue that we analyse in detail in our earlier work (Lau 2020). A non-essentialist understanding of this starting point is crucial to analysing the rise of modern science on a non-Eurocentric basis. The role of contingency in historical development (including intellectual development) cannot be stressed enough; most scholars, such as Needham, are ready to accept the effect of a contingent factor or event when it cannot be denied, but are averse to making contingency an explanatory variable as such, because they wrongly believe that it is merely haphazard and cannot be pinned down in a systematic way. On the surface, ‘contingent’ and ‘systematic’ do appear to be antithetical to one another, but this antithesis is only apparent, because while the appearance/occurrence of any *particular* contingent factor/event is accidental, it does not follow that *the presence (indeed, prevalence) of contingency in general in historical processes* cannot be conceptualized and hence analysed in a systematic way. In our approach, we precisely show how contingency, as a general and prevalent phenomenon, can be constituted into a systematically analysable variable with reference to the notion of sensitive dependence on starting point and path-dependency theory.

There are two components of our framework which non-Eurocentric scholars including advocates of dialogism shy away from, almost as a matter of principle, namely, scholarly tradition and scholarly agency. This is because, like Eurocentric scholars, they believe that these variables can only be understood on an essentialist basis. This is a huge conceptual mistake, in consequence to which much potential, non-essentialist explanatory power is lost. We show how scholarly tradition can be analysed on a non-essentialist basis with reference to neo-institutionalist theory in

organizational sociology and path-dependency theory in historical sociology, and, by cross-referencing Kuhn's notion of scientific paradigm, that recognition of scholarly tradition as a core explanatory variable enables the direct rebuttal of many cultural-essentialist arguments of both the Eurocentric and neo-Eurocentric varieties. It is also shown how and why scholarly agency can be given a non-essentialist interpretation, and, in Chap. 8, we show how it is precisely dialogism's failure to consider this factor, as part and parcel of its failure to analyse the phenomenon of intellectual development itself, that renders it incapable of accounting for Europe's breakthrough into modern science on the basis of what it had learnt from other civilizations.

The Greek tradition played a crucial role in the making of modern science as it had arisen in Europe, but the role of Greece in the analysis of the NQ has caused a lot of confusion among both Eurocentric and non-Eurocentric scholars alike. The nature of this confusion is encapsulated in the notion of the 'West' as purportedly a 'trans-historical' civilization beginning with Greece. In Chap. 4, it is pointed out that Greece and Latin Europe were two different civilizations, both in objective terms, and in the consciousness of the Greeks themselves, as well as that of Latin European scholars up to the late Renaissance. From Greek times up to the mid-nineteenth century, the notion of the 'West' did not exist, even as a collective identity, let alone a 'trans-historical' entity. In consequence to the Ottoman's conquest of Constantinople and the Byzantine Empire and further advance westwards, the notion of 'Europe' became the collective identity of Latin Europe (and only Latin Europe, excluding Byzantine and the Vikings—which is why we add quotes to the word *Europe* here), replacing its previous identity as (Latin) Christendom. As Latin Europe's scientific developments began to overtake that of the Arabic world, in the environment of rapidly rising racism consequent upon the success of the imperial enterprise and the intense hatred of Islam, Latin Europe's previous intellectual debts to the Arabs came to be increasingly denied while Greece was declared to be 'Europe's' 'childhood'. Science came to be seen as the purely 'autochthonous' development of this 'trans-historical' civilization originating in Greece and consummating in 'Europe'. During the eighteenth century, with France becoming the pre-eminent power and French replacing Latin as the official and high-society language, the notion of Europe shed its previous restriction to the Latin world and became understood in a vague geographical sense. Since in this sense Europe included states which differed greatly in terms of development (the main

divide being between western/central Europe and eastern Europe/Russia), whereas the above-mentioned notion of a ‘trans-historical’ entity developing on an ‘autochthonous’ basis was an elitist notion that tacitly referenced only the western and central European states, a conceptual inconsistency was created. This was overcome by the invention by the French positivist philosopher Auguste Comte in the 1840s of the notion of the ‘West’ as a ‘trans-historical’ civilization that included only the French, the Italians, the British, the Iberians and the Germans, with Greece as that civilizations’ origins. This notion was the basis upon which the Eurocentric view concerning the rise of modern science in its original form, as best exemplified by Weber, came to be formulated. Thus, the notion of the ‘trans-historical’ ‘West’ is a central pillar of Eurocentrism.

Today, even with Latin Europe’s debts to Arabic scholarship fully restored in a supposedly post-racism age, the notion of the ‘trans-historical’ ‘West’ still enables some Eurocentric scholars to maintain the original version of Eurocentrism almost in pure form. Deconstructing this notion is, hence, crucial to the critique of Eurocentrism; conversely, by showing that Greece and Latin Europe were two different civilizations, the case for dialogism is much strengthened. In our discussions with non-Eurocentric scholars, we find many of them reluctant to do away with the notion of the ‘trans-historical’ ‘West’. Besides inertia, one reason for that is the mistaking of Europe’s *adoption* of the Greek tradition (not only in science and philosophy, but also in various cultural fields) for the *organic development of the same entity* over time at different stages. This mistake can easily be seen from the fact that no one would regard the Arabic world that adopted the Greek tradition and Greece to belong to one and the same trans-historical entity; and the reason for this is obvious, the ancient Greeks were white,<sup>4</sup> while the Arabs were not, which also goes to show that for those who reject racism but continue to speak of the ‘West’ as a ‘trans-historical’ entity, complexion might well still somehow carry extra-physical implications without themselves being aware of it.

Given the role of the Greek tradition, a non-essentialist understanding of how the Greeks came to establish their particular tradition is most crucial. This is especially because this issue has always been given essentialist interpretations. In Chap. 3, this issue has been addressed in a preliminary way, Chap. 5 pursues it further from another angle. In the literature, there

<sup>4</sup>White, black, and so on are valid categories of population groups without carrying racist implications (Malik 2008).

is a thesis concerning Greece in comparison to China which is of special significance because, firstly, it is the most sustained and systematic social-essentialist analysis concerning intellectual development available and its social essentialism takes the form of sociological reductionism, hence it provides an ideal case for the critique of social essentialism and sociological reductionism; secondly, it is exactly identical in form to Weber's original formulation of the Eurocentric position; and, thirdly, it also exactly matches the dual form in which Needham raised the NQ, which, as previously remarked, is conceptually flawed. This thesis is what we refer to as the 'agora debate' thesis advanced by the classical scholar G.E.R. Lloyd and the sinologist Nathan Sivin in a collaboration that lasted three decades until the latter's passing away in 2022. A single social factor, namely, the presence or absence of agora debate, is argued to be what accounts for a series of scholarly achievements attained by, and supposedly only by, the Greeks (the search for ultimate foundations, element theories in physics, the 'invention' of the concept of nature, and so on), which the Chinese are said to lack. We show that each and every one of Lloyd's and Sivin's claims is empirically false, which goes to show the theoretical bankruptcy of their social essentialist and sociological reductionist views. In the process of our critique, we also examine the general issues of how to critique social essentialism depending on the different circumstances of each particular argument, and of the flaws of sociological reductionism.

In making claims of knowledge transmissions from China to Europe, Needham often depended solely on chronological priority for support; this is clearly insufficient, and has justifiably been critiqued. In order to minimize the extent to which Europe benefited from knowledge transmissions from non-European civilizations, some Eurocentric scholars, however, go to the other extreme, by demanding evidence of transmission in accordance with the legal criterion and principle of the onus of proof and the presumption of innocence, as in the criminal law court. On the criterion of onus of proof, or more fully, proof beyond reasonable doubt, many knowledge transmission claims can be dismissed out of hand without further ado, and, in accordance with the principle of the presumption of innocence until proven otherwise, the presumption of independent invention when knowledge transmissions cannot be proven beyond reasonable doubt is said to constitute 'common sense'. However, it is common knowledge that in historical investigation, direct evidence often does not exist or has not survived or has not survived in sufficient amounts to satisfy the criterion of proof beyond reasonable doubt. Hence, leading

scholars in various historical disciplines, ranging from archaeology, classical studies to historical linguistics, adopt a different criterion, namely, the balance of probabilities or plausibility on the basis of indirect evidence (which, incidentally, also often does not exist or has not survived), and, especially, circumstantial evidence. On this criterion, there is no need to either presume independent invention or, for the matter, transmission or diffusion, since that is wholly decided by the balance of what is more probable or plausible. Chapter 6 examines these issues, in which various cases of knowledge transmission claims and their rejection on the above-mentioned legal basis by Eurocentric scholars are examined. This examination, however, is not in order to adjudicate between those who make and those who reject the claims concerned, but to illustrate methodologically the general principles involved concerning evidence in historical investigation, especially in relation to the debate between Eurocentrism and dialogism with regard to the rise of modern science.

Given the general acceptance of the Arabic world's taking up of the Greek tradition and Hindu mathematics, and of Latin Europe's intellectual debts to Arabic scholarship, it may come as a surprise to find some Eurocentric scholars still arguing that there are allegedly 'cultural obstacles' to knowledge transmission across different cultures. But such arguments do exist up to the present day, and, what is even more surprising is that, on at least one important occasion, none other than Needham had made one such argument, even to the extent of talking about 'ethnic obstacles'. In formulating our theoretical-methodological framework in Chap. 3, we discuss how a non-essentialist understanding of scholarly tradition enables, *inter alia*, a clear understanding of, on the one hand, the general non-culture-specific nature of scholarly tradition, and, on the other, why there could sometimes occur, *for non-cultural reasons*, obstacles to knowledge transmission across different cultures or societies. In Chap. 7, we employ this framework to examine certain cultural-essentialist claims of 'cultural barriers' to knowledge transmission. This is done by means of a detailed examination of the reception of Euclid's *Elements* in China over the centuries, and of the introduction of the Tycho Brahe model and the telescope to China in the late 16th to early 17th centuries. By coincidence, the introduction of the telescope to China is used by the historical sociologist of science Toby Huff to advance a cultural-essentialist neo-Eurocentric 'intellectual curiosity' argument. We show how Huff's own analysis actually cancels out his own argument, and how his argument betrays an extraordinarily simple-minded conception of how scholarship

develops, according to which scholarship develops like blank calculators, each and every one of which is expected to automatically produce the same output given identical inputs.

To explain how and why Latin Europe was able to make the breakthrough into modern science, one must first define what that breakthrough consists of. For our limited purposes (see above second paragraph), we do so with reference to four elements: (1) The breakthroughs achieved by Kepler and Galileo; (2) the methodical and systematic use of the experimental method to test hypotheses about nature; (3) the rise of the mechanical philosophy; and (4) the mathematization of nature. These four elements more or less parallel Cohen's thesis that the breakthrough into modern science consists of what he calls three 'revolutionary transformations', namely, the rise of realist mathematical science (roughly corresponding to our first element); Descartes' kinetic atomism (this coincides with part of our third and fourth elements); and the rise of experimental science (this corresponds to our second element). In Chaps. 8 and 9, we analyse our four elements from the perspective of our theoretical-methodological framework, in the course of which, we contrast our analysis with Cohen's in a critique of the latter.

Due to a contingent coincidence, the Islamic world of the Middle Ages was located between Byzantine and India, in close proximity to both. As a result, when it began to borrow learning from foreign civilizations, it borrowed both the theoretical tradition developed by the Greeks and what we refer to as the computational tradition of Hindu mathematics. In consequence, right from the beginning, there existed a strong trend in Arabic scholarship towards the realist direction in its adoption of the Greek corpus, as exemplified by the optical theory of Ibn al-Haytham and Arabic astronomers' reform of Ptolemy. When Latin Europe learned from Arabic scholarship, this realist trend was also absorbed. In speaking of his first 'revolutionary transformation', Cohen refers to Kepler's and Galileo's work as the transformation of the Alexandrian mathematical science of Ptolemy and others into 'Alexandria-plus', i.e. Alexandrian mathematical science made realist. Cohen's argument completely ignores the fact that late-Renaissance European scholars had absorbed Arabic scholarship's trend towards realism, hence his argument of Alexandria being directly transformed into 'Alexandria-plus' by late-Renaissance Europe is Eurocentric. Such a critique of Cohen's argument can be made within the parameters of the dialogical perspective. However, Kepler and Galileo did go beyond Arabic scholarship, an advance that cannot be explained within

those parameters. In Chap. 8, we analyse, on a non-essentialist basis, how a synthesis of contingent external factors in the post-1453 era led, as contingent unforeseen consequences, to a fundamental shift in Latin Europe's scholarly climate, in which crucial changes occurred in the scholarly agency (scholarly values and drives) of late-Renaissance scholars such as Kepler and Galileo. It is from this angle, completely explicable on a non-essentialist basis, that the ability of Kepler and Galileo to go beyond Arabic scholarship can be accounted for, thereby showing the need to transcend the dialogical perspective in critiquing Eurocentrism and neo-Eurocentrism.

In his thesis, Cohen credits Bacon for his third 'revolutionary transformation'. According to him, in the 15th and 16th centuries, there developed a 'specifically European-coloured mode' of 'coercive empiricism', which Bacon 'consolidated' into the experimental method of the seventeenth century. In Chap. 9, we show that Cohen is wrong in both respects. Cohen's 'coercive empiricism' had not arisen from purely internal European dynamics, as claimed by Cohen ('specifically European coloured mode'), but from circumstances arising from the hostile relationships between Latin Christianity, Byzantine, and the Islamic world. The seventeenth century's use of experimentation to test hypotheses about nature had nothing to do with either 'coercive empiricism' or Bacon, nor was there any 'revolutionary transformation' involved at all, because experimentation had existed for a long time in alchemy which was first borrowed from the Arabs. Over several centuries, alchemy had developed experimental processes to prove the corpuscular theory of matter, but alchemy's corpuscular theory (subsequently to be called 'chemical atomism' in the nineteenth century) was experimentally based, and owed nothing to Democritean atomism, which was a physical theory. It was as part and parcel of this tradition that Robert Boyle's mechanical philosophy emerged, which was again experimentally based, and which completely dispensed with the Aristotelian notion of 'substantial form' by explaining, on the basis of the precedent set by his immediate alchemical predecessor Daniel Sennert, qualitative changes in terms of variable accidental relations between component parts.

On the other hand, inspired by Galileo's work on motion, Descartes took up Democritean atomism by giving it a kinetic interpretation. In focusing on the accidental kinetic relations between component parts (Democritean atoms), Descartes' theory, like Boyle's, though sharing no common heritage with Boyle, also embodies the mechanical worldview. To analyse the kinetic relationships between Democritean atoms, Descartes

synthesized geometry and algebra so as to provide the mathematical tools required. Since algebra was borrowed from India through Arabic mathematicians, Cohen's description of his second 'revolutionary transformation' as the transformation of Athens (Athenian natural philosophy) directly into 'Athens-plus', i.e. Descartes' kinetic interpretation of Democritean atomism and its mathematization, is Eurocentric because it ignores the role played by algebra in its synthesis with geometry.

After discussing his three 'revolutionary transformations', Cohen then asks why they all occurred at around the same time. There are problems with this very question itself, but what is most interesting is Cohen's answer to his own question. This answer is of the cultural-essentialist variety because it talks about 'unique' European 'qualities' such as 'dynamism', 'curiosity', and so on; at the same time, it is neo-Eurocentric because Cohen accepts, at least verbally, the role played by borrowed knowledges from non-European civilizations, and his argument is that Europe was able to make the breakthrough on the basis of such borrowings due to the above-mentioned 'unique' European 'qualities'. Cohen's answer is nothing new at all, it is, in fact, nothing but the turning of the outdated ideological 'voyages of discovery' narrative into a pseudo-explanation. The reason why Cohen's answer constitutes only a pseudo-explanation is explained by contrasting it to our own analysis of late-Renaissance scholarly agency. In offering his pseudo-explanation, Cohen is able to recruit support from a lengthy comment made by none other than Needham that contrasts Europe with China. Not only is Needham's comment with regard to Europe also derived from the same outdated ideological narrative, we show that each and every element of his comment with regard to China is directly contrary to the simplest historical facts about China. This may surprise many readers who are unfamiliar with China and who take Needham to be the authority on China. Needham's knowledge of China's technological development is certainly formidable, but the same cannot be said of his knowledge of other aspects of China. Further, Needham was certainly aware of at least some of the contrary facts mentioned by us, but his remaining under the ideological grip of the 'voyages of discovery' narrative is such that these historical facts simply escaped him when he made his lengthy cultural-essentialist comment on China that Cohen finds so congenial.

The 'voyages of discovery' narrative pertains to the positive NQ only, since, like Needham, Eurocentric and neo-Eurocentric scholars invariably raise the NQ in dual form, an argument that matches precisely the

‘voyages of discovery’ narrative in form but which addresses the negative NQ to complement that narrative is required. This is provided by one half of an overall argument that we refer to as the ‘maritime versus continental civilizations’ (MvC) narrative, which was spawned by the ‘voyages of discovery’ narrative. According to the MvC narrative, Europe constituted a ‘maritime civilization’, ‘outwardly oriented’, ‘lured’ by and ‘curious’ about the sea and what lies in its far reaches, and ‘fearless’ of its hazards, while China, which serves as an illustration of non-Europe, was a ‘continental civilization’, ‘inwardly oriented’, ‘bound’ in ‘self-sufficiency’ to the land, ‘incurious’ about what lies beyond this ‘self-sufficient’ land, and ‘shying away’ from the hazards of the sea. The ‘M’ component of the MvC narrative is none other than the ‘voyages of discovery’ narrative; while Needham’s claims about China made in his above-mentioned lengthy comment cited by Cohen for support constitute some of the elements comprising the ‘C’ component of the MvC narrative. The ‘M’ component has been subject to adequate critique in Chaps. 8 and 9, in view of the fact that the MvC narrative lies at the root of most cultural-essentialist arguments, which have become especially prominent with the rise of neo-Eurocentrism, a more comprehensive critique of the ‘C’ component of that narrative is required. We include an appendix especially for that purpose.

In the Conclusion, a chart to graphically represent our approach and overall argument is provided. With reference to an observation of the critic of Eurocentrism Jack Goody that echoes our own view, we finish with a comment on the readiness of Eurocentric scholars, from Weber to Cohen, Huff, and others, to jump to conclusions about non-European civilizations despite their (sometimes self-acknowledged) limited knowledge of these civilizations, as well as propose an explanation as to why such a readiness is rife among such scholars.

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