THE GRAND TITRATION: REVISITING THE WORK OF JOSEPH NEEDHAM TO ADDRESS ETHNOCENTRISM IN CONTEMPORARY PHILOSOPHY AND SOCIETY

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ABSTRACT: Understanding different cultures has long been a hurdle for philosophy. In 1954, Joseph Needham commenced the most substantial literary example of such an undertaking, titled *Science and Civilisation in China*. The multi-volume historiography (currently 25 books) represents an awe-inspiring triumph of painstaking scholarship and remains one of the most significant western efforts to document Chinese thought to date, systematically detailing 25 centuries of Chinese discovery in mathematics, physics, chemistry, technology, medicine, and metaphysics. As well as documenting Chinese history, his magnum opus asks a major question: "Why did modern science, the mathematization of hypotheses… with implications for advanced technology, take its meteoric rise only in the West?" Needham sought to uncover why, despite centuries of prolific discovery, China was overtaken by the west and, consequently, why Asian thought is seen to be antiquated in comparison? Through answering this question, Needham's goal was a better understanding of Chinese language, culture, religion, and philosophy, with the hope of better understanding Western culture in turn. To this extent, Needham was immensely successful, and the implications have an immense potential for philosophy today. With this in mind, this article has two aims, firstly to recapitulate Needham's work in order to bring his valuable insight back to the attention of contemporary philosophy. Secondly, the article aims to assess if the immense potential of Needham's cross-cultural analysis can be used to overcome current problems stemming from the ubiquitous reach of Western culture. Even though Needham himself was also deeply entrenched in European thought, and overcoming this bias was never his explicit aim, he nonetheless constructed a powerful and prolific exchange between diverse cultures. With the spread of neo-liberalism and the abuse of democratic systems, there has been a resulting increase in political disempowerment, economic inequality and environment devastation, thus this article will analyse whether such a dialectic of diverse cultures can lead to the construction of a post-Eurocentric philosophy with a greater appreciation for the biosphere.

KEYWORDS: Joseph Needham; Philosophy; East and West; Science and Civilisation in China; Process Philosophy

INTRODUCTION

It may come as a surprise to many that the development of sophisticated science, technology, and medicine in ancient history was not exclusive to Europe. In fact, many great civilisations in the ancient world had their own advanced scientific and technical traditions. This is most notably the case in China, where many key scientific and technological discoveries pre-date their appearance in Europe and are well documented due to the early development of writing in China during the Shang Dynasty (approximately 1400–1100 BC).[1] This is noteworthy in itself, as although the development of Chinese writing came later than Mesopotamian cuneiform and Egyptian hieroglyph, these languages have long been dead while the Chinese ideograph (and the history it reveals) still exists today. The history of discovery and invention in China is also particularly of interest due to the larger distances between China and the central nodes of creativity in Europe, meaning that China was more independent of European influence than the Islamic and Indian traditions.[2]

Joseph Needham, initially an accomplished research biochemist for the Royal Society, was already a leading scientist in the Western tradition by the time he started researching Chinese traditions, holding a chair in biochemistry at Cambridge University. He was also no stranger to extended publications, having given a systematic three-volume exposition on Chemical Embryology in 1931 that totalled approximately one million words. He came to a turning point when his attempt to synthesise the most recent advances in physics and philosophy into a new approach to bio-mathematico-physico-chemical morphology was blocked by the university. This motivated him to start research in his other interest; the history of science and technology in China, an interest that manifested out of conversations with his Chinese research assistants. By this point he was already in his thirties and had a deep understanding of the whole history of Western science and philosophy, of its achievements and (most recently) its limitations, giving him a vast foundation on which to build his analysis.

After conducting a small amount of research into the history of Chinese science, Needham soon discovered that Francis Bacon's celebrated 'holy trinity' of Western civilisation, the three inventions that for Bacon exemplified and guaranteed European intellectual dominance over the world (gunpowder, printing and the compass) were in fact Chinese inventions. Other technologies claimed to be Western inventions that advanced Europe to the forefront of sophistication, Needham found, were actually

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[1] Joseph Needham, *Science and civilisation in China: vol. 1: Introductory orientations,* London, Cambridge University Press, 1954, p. 32.

[2] Nathan Sivin, 'Why the scientific revolution did not take place in China–Or didn't it?' *Chinese Science*, no. 5, 1982, p. 47.

originally invented in China: such as the stirrup, chain drives, suspension bridges, blast furnaces, wheelbarrows, toilet paper, playing cards, vaccination, chess, the definition of Pi, as well as many others. Needham was understandably surprised, and later announced that the Chinese had demonstrated "a promising start" and that "the early Taoists (in China), not only curious about what they saw, but observing nature patiently and persistently, were proto-scientists".[3] This description is particularly noteworthy, as he uses the Western idea of a 'scientist' to describe a group of thinkers who did not (and could not) describe themselves in such a way. Regardless, Needham uses this description to contextualise these traditions within Western thought so they may be compared on level footing, and to plot them within the history of modern science, a process that became the framework for his *Science and Civilisation in China* project.

Science and Civilisation in China meticulously catalogues and analyses the history and development of science, technology and medicine in China, and comprehensively embeds each element in its social and intellectual context, all illuminated through Needham's own deep and sympathetic understanding of both Eastern and Western science and culture. The first book in this project was published by Cambridge University Press in 1954, and further volumes of the project continue to be published today. *Science and Civilisation in China* presently stands at 7 volumes, with each volume bearing multiple parts. The varying depth of research required for certain parts meant that many books were published out of sequential order, the final book in the series is volume 7, Part 2: *General Conclusions and Reflections* and was published in 2004, although volume 5: parts 7 and 10 are yet to be completed. When these parts are published, the project will total 27 books. The passion and knowledge that Needham poured into this project has catalysed a radical change in the way scholars and scientists evaluate not only the history of Chinese culture, but the history of cultures all around the world. Needham's tireless work has also demonstrated the way that the history of science, medicine and technology can come to be understood in a global perspective and as part of the common inheritance of all humanity.

The combined aims of this this article are to recapitulate Needham's project, and utilise the basis of his research to argue for a post-Eurocentric philosophy that facilitates understanding and recognition of the diverse cultures that do (and did) exist throughout the world. The overarching idea throughout this article is that what is required in the present global landscape of fear and misunderstanding between

[3] Joseph Needham, Kenneth Robinson, Ray Huang and Mark Elvin, *Science and civilisation in China: vol. 7: The Social Background, Part 2: General Conclusions and Reflections'*, London, Cambridge University Press, 2004, p. 226.

religions and cultures, particularly the present treatment of Islam by the West, is such a philosophy that that promotes greater recognition of the autonomy and intelligence of all peoples and cultures. The argument will be raised that Needham's work presents a prototype of this kind of thinking, as well as a starting point from which we can develop a philosophy that overcomes the deficiencies in Western European thought and appreciates the history and autonomy of other cultures.

SCIENCE AND CIVILISATION IN CHINA

In 1954, Joseph Needham presented the world with the first volume of the most substantial contribution to the Western understanding of Chinese science and philosophy, titled *Science and Civilisation in China* (hereafter *SCC*). A monumental example of meticulous research, it was described by one review as "perhaps the greatest single act of historical synthesis and intercultural communication ever attempted by one man".[4] The multi-volume historiography represents not only an awe-inspiring achievement of painstaking scholarship, but amounts to the most significant effort to exchange Chinese and Western thought to date. His work exhaustingly details and systematically analyses 25 centuries of Chinese discovery in mathematics, astronomy, physics, chemistry, geology, zoology, botany, technology, medicine, metaphysics and many other fields. This massive study was fuelled by a number of aims, most notably to reveal to Western academia the level of advancement and technology present in the long history of a culture thought to be uncivilised and archaic. Further to this aim, Needham was also advancing a Chinese—influenced philosophical perspective, which was inspired by Alfred North Whitehead. Incorporating Whitehead's process philosophy is a significant advancement, as Whitehead's work is important both historically and academically, as it has radically revolutionised and advanced biological theory and science as a whole.[5]

As mentioned above, Needham was already well established in the scientific field by the time he started writing SCC, but his fascination in the history of science can be traced back to his three-volume textbook *Chemical Embryology*, in which he included a 300-page history of embryology. Clearly intent on more than just practicing science, Needham demonstrated an intrigue in uncovering the essence of scientific thought, and how it develops over time. For Needham, science was a philosophical endeavour that consisted of demonstrating the unity of knowledge. Even as a biologist, Needham recognised the limits of positivism and the Eurocentric approach to science, which was inherently reductionist. Thus, his conception around scientific research, instead of

[4] Mark Elvin, 'The work of Joseph Needham', *Past & Present*, vol. 87, no. 1, 1980, p. 17.
[5] Arran Gare, 'Understanding Oriental Cultures', *Philosophy East and West*, vol. 45, no. 3, 1995, p. 312.

positivism, was to decode the relationship between science and society, and to consider the history of science as integrated with social and cultural contexts. In taking a path contrary to reductionism, for Needham, science becomes considered a part of the fabric of society, as opposed to merely an "autonomous delving into nature's mysteries". Needham express his reasoning for this:

> The great stumbling block here for the internalist school of historiography of science is the central question of historical causation. Scenting economic determinism under every formulation, they insist that the scientific revolution, as primarily a revolution in scientific ideas, cannot have been derivative from some other social movement ...they do not like to admit that scientists have bodies, eat, drink, and live social lives among their fellowmen.[6]

Needham explains that since science is operated by people, you cannot divorce the human elements from the study of science, thus, science is fundamentally entwined with society. This means that also, for Needham, science is not limited to the annals of European libraries but is part of the shared inheritance of all humans:

> If one defines science as modern science only then it is true that it originated only western Europe in the 26th and 27th centuries in the late renaissance, the life of Galileo marking the turning point. But that is not the same thing as science as a whole, for in all parts of the world ancient medieval peoples had been laying the foundations for the great building that was to arise.[7]

It is this principle that motivates Needham's exploration into science in *SCC*.

Needham highlights the difficulties of previous efforts to describe the origins of science and development of other civilisations, and in doing so notes that further refinement is necessary, thus showing what he is attempting to accomplish in *SCC*:

> I believe that the analysable differences in social and economic pattern between China and Western Europe will in the end illuminate, as far as anything can ever throw light on it, both the earlier predominance of Chinese science and technology and, also, the later rise of modern science in Europe alone.[8]

This is an accurate description of the task of *Science and Civilisation in China*, yet presents a modest picture of the philosophical basis of the work. As well as presenting a comprehensive contrast on the level of science and technology in Chinese history, *SCC* also lays the foundation for both a critical comparison and synthesis of Eastern and

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[6] Needham et al., vol. 7: Part 2: General Conclusions and Reflections, p. 3.

[7] Joseph Needham, The grand titration: Science and society in East and West, Toronto, University of Toronto Press, 1969, p. 116.

[8] Joseph Needham, 'Science and society in East and West', *Science & Society*, vol. 28, no. 4, pp. 385–408, 1964, p. 408.

Western philosophies.

In the interests of brevity, this article will not provide an in-depth analysis of all 7 volumes and 25 books of *SCC*. Only the first two books will be intimately studied, as they both relate to the ontology and philosophy of science in China and therefore form the epistemological foundation of Needham's philosophy. The proceeding volumes of *SCC* are specific to individual fields of science and technology (e.g. Medicine, Engineering, Chemistry) and will be referenced directly on occasion, but generally approached through a meta-analysis, and thus discussed as contributing to and emerging within the over-arching philosophy. It is worth noting that Needham's work is just as much concerned with raising and addressing philosophical questions as it is concerned with the history of science. Whether the questions concern the hierarchies of the natural world, human nature, social change, morality, mortality, critical thinking or pedagogy, Needham conducts his exploration into the history of science within the Chinese context, and in doing so, erects the foundations of his comprehensive philosophy.

The first volume of *SCC*, titled *Introductory Orientations* begins with a characterisation of the language and writing in China. By analysing the language, Needham is orienting the reader with a Chinese ontology, since, as Heidegger shows, language is key to understanding *dasein*. This is an important link also, as Heidegger too was concerned with constructing a dialogue between Eastern and Western thinking. Needham's introduction to Chinese writing was also integral as a starting point for his comparative philosophy, as semiotics are key in constructing reality and the understanding of the world, as shown by Peirce's triad.[9] The first volume transitions from writing and language to provide a background on geography and history, and the conditions which brought about the transmission of scientific and technical ideas between China and Europe. And thus, the first volume is presenting the foundations of the Chinese worldview and qualifying the reader for future volumes.

The second volume of *SCC* is titled *History of Scientific Thought* and is often considered to be the most controversial, as it begins to critically juxtapose development in Chinese against development in Europe. This volume offers a study of the differing systems of thought and worldviews that emerged and came to prominence within Chinese history, then concludes with how the laws of nature formed within China and Europe. The motivation for gathering and presenting these worldviews is to accurately document the epistemological and phenomenological factors that contributed to (or for

[9] Jesper Hoffmeyer, *Signs of meaning in the universe: Advances in semiotics*, Indianapolis, Indiana University Press, 1997, p. 17.

Needham, impeded) the development of a scientific tradition in China. The comparison that Needham constructs between Chinese and European systems of thought explores the foundation of each of these systems in terms of historical and cultural context, and more importantly in terms of the social, political and philosophical factors that were catalysing the genesis of scientific and technical development in each civilisation. Needham situates this development in relation to social, religious and economic conditions, such as class conflict and the general worldview of each tradition. These explanations are revolutionary for a study of the history of science, as they are drawing a clear connection between the social and cultural fields and the scientific field.

This connection forms an important undercurrent within *SCC*, as mentioned above, Needham continuously considers science and society as fundamentally entertained, and thus describes scientific discoveries as they emerge from social and technical activity. He demonstrates also that much of the discovery is occurring through accident or necessity, and thus these are not documented scientifically in the same way as the formal Western scientific tradition. Yet, to contextualise these discoveries for the reader, and to plot them as precedents within the history of modern scientific theories and concepts, he chooses to describe them using the vocabulary of Western science, and thus imbues them with scientific connotations. This is well documented even in the table of contents of *SCC*, where he classifies the Chinese discoveries, technology and knowledge by using the names of modern scientific disciplines and the well-regarded links between these disciplines.[10] This is very much in line with his overall aim of *SCC*. Though he is aware that these specific subjects (and their names) did not exist in historical China as individual, autonomous areas of knowledge, they still represent the intellectual prototypes of the ultimate forms of modern science that Needham maintains would have been the logical conclusion of Chinese development. This approach also imbues these historical actions with significance in the Western scientific tradition and demonstrates the analogues of modern tools and ideas within ancient Chinese history, as well as the inferring the transmission of these ideas between China and other cultures. Needham often employs the imagery of rivers as an analogy to infer this transmission, as well as using it as a metaphor to describe his synthesis of Eastern and Western traditions (discussed later).

[10] Needham, vol. 1: *Introductory orientations*, pp. xxii-xxxvii.

THE GRAND QUESTION

This discussion leads to the big question that has been asked by many scholars and, of the most relevance to this research, the question that undoubtedly underlies Needham's monumental work: If Chinese society surpassed Western civilisation in scientific development for 1500 years, why did the 'modern' scientific revolution not take place in traditional China? Throughout China's history, the different ruling groups have brought their own set of social and political ideals, and for the most part these were conducive to the development of science. Until the 16th century, in fact, China was characterised by continuous technical, administrative, economic and artistic progress.[11] The two main reasons for this progress were that scholars were selected to prominent positions not by birth but on talent and merit, and that the lives of farmers and communities was rarely intervened in by the elites in the way that was characteristic of feudalism in Europe. Needham's approach to answering this question is structured by a kind of historical materialism in which he examines the socio-economic, political, and religious factors that prevented the genesis of a modern scientific revolution in China. The deeper he delved into the history of Chinese scientific development, the more complex the answer became:

> The study of great civilizations in which modern science and technology did not spontaneously develop obviously tends to raise the causal problem of how modern science did come into being at the European end of the Old World, and it does so in acute form. Indeed, the more brilliant the achievements of the ancient and mediaeval Asian civilizations turn out to have been the more discomforting the problem becomes.[12]

In spite of the increasing complexity of the problem, Needham continued to make the explanation of why China did not develop modern science central to his work. Within his documentation of Chinese discovery, he also sought and identified elements of Chinese society that could have slowed or impeded the causation of specific historical conditions that brought about the scientific revolution in Europe.

The drawing of this comparison stems from the Marxist foundations of Needham's philosophy, specifically the orthodox Marxist assumption (influenced by Hegel) that all societies follow the same route of historical development and simply progress at faster or slower rates. An explicit reading of this view may be considered overly simplistic (and archaic) from a contemporary philosophical perspective, and Marx came to the conclusion later in life that a universal theory of history was not able to sufficiently

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[11] Joseph Needham, *The grand titration: Science and society in East and West*, Toronto, University of Toronto Press, 1969, p.210.
[12] Ibid, p. 214.

explain the complex conditions surrounding the development of individual societies. He specifically refers to "the Asiatic… mode of production" as signifying the conditions for social and economic development.[13] Needham came to agree with this, and highlights Chinese history as an example of the Asiatic mode of production, illustrated by the resistance by the Chinese villagers to their domination resulting in a less oppressive society than feudal Europe. Regardless, this theory does lay the foundation for understanding that autonomous societies possess a certain teleology, in that they inevitably develop towards greater complexity and sophistication. As a consequence, Needham's intellectual outlook, based upon the conviction of the ultimately progressive (and essentially narrative) nature of history, provides the foundation for the aim of this paper to develop a post-Eurocentric philosophy.

As highlighted above, the further Needham delved into the history of Chinese scientific development, the more factors he discovered to have interacted with the dampening of the growing Chinese science. For example, one suggestion he made was that the lack of scientific and technological innovation was partly due to a lack of competition within the unified Imperial China under the Ming emperors. The period under the Ming emperors is regarded as a time of peace throughout China and is thus in stark contrast to the cacophony of competing (and often warring) states within Europe. The hypothesis being that the endless struggle for supremacy in Europe fuelled the explosive development of social and military advancement, while the peace in China extinguished it. Another potential answer to Needham's question was the idea that the "bureaucratic feudalism" of modern China prevented further scientific and technological discovery. Needham pointed out that the development of the bureaucratic ruling class created a distraction from social and intellectual progress. Lowering the top rung of society from an unobtainable imperialism to the autocratic aristocracy that we see today made the bureaucratic ruling class the aspiration of the general population. The smartest men in the nation were ingrained with the idea that the image of success was to become one of the unquestioning officials who ran China unerring from the status quo. As a consequence, all of the brightest minds of Chinese society aspired to become powerful bureaucrats as soon as they left school, instead of studying to be doctors, scientists or engineers. This had significant consequences for the level of discovery and innovation in historical China. Although Needham notes that not all scientific and technological discoveries occur in the formal laboratories of doctors and scientists, great minds are more likely to make contributions to knowledge

[13] Karl Marx, *A Contribution to the Critique of Political Economy*, trans. S.W. Ryazanskaya, Moscow, Progress Publishers, 1859, p. 13.

in this sort of environment with an education in these fields than if they were a bureaucrat unquestioningly following the tenets of Neo-Confucianism.

There were significantly more issues explored by Needham in his attempts to answer his 'grand question', and it is worth noting that a short article such as this can never do justice to the subtlety, complexity, and painstaking scholarship that went in to the tens of thousands of pages of Needham's work. As well as the Marxist (socio-economic) factors, Needham also explored the religious, political and cultural factors that influenced the history of science in China.

Such explanations are, I believe, capable of much refinement. They must in no way neglect the importance of a multitude of factors in the realm of ideas— language and logic, religion and philosophy, theology, music, humanitarianism, attitudes to time and change—but they will be most deeply concerned with the analysis of the society in question, its patterns, its urges, its needs, its transformations.[14]

Unfortunately, the more factors that he gathered in his investigation, the more his question broadened. The increasing array of resulting answers made it less clear that there could be one definitive answer (and especially not one "grand" answer). In spite of the fact that Needham undertook his investigation primarily in order to answer this ultimate question, what he undoubtedly accomplished instead was a comprehensive and masterful historical analysis of scientific and technical development through China's history. And this, arguably, is more important, for what emerged from Needham's historical analysis is an unprecedented understanding of Chinese history and culture. Using this as a foundation, there is the possibility of an analysis of both Western and Eastern philosophies, as will be discussed further below.

CONTRASTING DIFFERENT TRADITIONS

As well as a meticulous narrative of Chinese history, *SCC* also presents an evaluation of the many traditions of thought that came to prominence during Chinese history. Many perspectives in Asian studies consider Chinese thought to be a single exotic tradition. Needham, on the other hand, undertook the complex task of detailing the historical emergence and ideology of every tradition that carried a significant bearing on the development of science in China, and assesses the merit of these traditions through both their successes and failures. This is particularly the case in volume 2 of *SCC*, titled *History of Scientific Thought*, wherein Needham dedicates a chapter to each major tradition.

He begins with Confucianism (rú jiā), since this tradition bore the most significant

[14] Needham, 'Science and society in East and West', pp. 406-407.

influence throughout history and later came to dominance over all modern Chinese thought. It should be noted, though, that Needham discusses the Confucian tradition as having a wholly negative contribution to Science, as he shows that the Confucian attitude to knowledge never wavered from the standpoint that natural phenomena were not worthy of study and that "man and human society were alone worthy of investigation".[15] From the Confucians, he transitions to their adversaries: the Taoists (dào jiā). He discusses the Taoist tradition in a more positive way, and shows that their mode of thinking lies at the basis of all Chinese thought. What is particularly interesting for Needham in the context of his overall project is that the natural science constructed by the Taoists is almost identical to pre-Socratic Greek thought: "[Taosim] is devoted to the doctrine that water is the original element of all things and the ground of change, in other words a doctrine analogous to that of Thales of Miletus (fl. - 585), first of the pre-Socratic nature-philosophers".[16] Most notably, he highlights the similarities to the Greek dialectics of nature "the ever-recurring opposition between the old decaying factors and the new arising factors at any given stage" and shows that Taoist literature describes these cyclical changes in "no uncertain terms".[17] This already sophisticated natural science matured to become a framework very similar to the contemporary field of ecology: "Taoists imagined the universe as dynamic web of relations, whose events constitute the nodes; each action of a living creature modifies its relations with its environment, and the consequences gradually propagate to the whole of the universe".[18]

The third tradition that Needham discusses is the Legalists (fǎ jiā), who were devoted to the stipulation and codification of law. They were largely responsible for replacement of feudalism with the feudal-bureaucratic state, and were authoritarian almost to the point of fascism. This was their inevitable undoing as, when the Chhin dynasty overreached itself in the 12th dynasty and were replaced by the Han, the Legalists came to be identified with the excessive tyranny of the Chhin and came to grief themselves as a consequence. The formal legal principles of the Legalists remained though, and merged with the Confucian tradition to form the form the bureaucratic and social framework of the neo-Confucian ideology that would come to dominate.

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[15] Joseph Needham, *Science and civilisation in China: vol. 2: History of scientific thought*, London, Cambridge University Press, 1956, p. 1.
[16] Ibid, p. 42.
[17] Ibid, p. 75.
[18] Andreé C. Ehresmann and Jean-Paul Vanbremeersch, *Memory evolutive systems: Hierarchy, emergence, cognition*, Amsterdam, Elsevier, 2007, p. 21.

There were other key traditions that came to dominance and then faded away during this period of development, which Needham documents in volume 2 of *SCC*. There were the Mohists (mò jiā), who Needham described as "chivalrous military pacifists with an interest in scientific method and even experimentation arising out of war techniques".[19] Also making a significant contribution were the Logicians (míng jiā), who were comparable to the Greek sophists in their attention to rhetoric and documenting of paradoxes and semantics. Finally came the School of the Naturalists (yīn yang jiā), who developed a philosophy of organic naturalism and contributed a number of fundamental theories to Chinese proto-scientific thinking. Although none of these traditions stayed in power indefinitely, they each made large contributions to the greater Chinese ontology and each maintains a lingering presence in the present tradition. Notably, as well as comparing these traditions in isolation, Needham also compared them with each other and demonstrated how they historically developed in dialectic. For example, the 12th century Neo-Confucians of the Sung dynasty reacted to the continuing challenge from the emerging Taoist tradition along with the challenge from the newly developed Buddhist tradition by appropriating elements from these ideologies and absorbing these elements into the neo-Confucian cosmology. By virtue of this, the resulting neo-Confucianism was able to present a perspective of these other traditions from within its own context.

This kind of ideological "hostile-takeover" is symptomatic of a larger point to be made when comparing different cultures and traditions, that no one cultural tradition is free from the greed for power, dominance, protectionism, and associated brutality. Examples of this kind of behaviour easily spring to mind when considering European colonialism, but it should be noted that Chinese, Mesoamerican, and even indigenous Australian history is rife with examples of greed, egoism, arrogance, and unimaginable cruelty. The point is not that any one culture is perfect, but that by understanding more about other cultures we are better able to observe the deficiencies in our own culture, creating the opportunity for improvement. By developing understanding and recognition of other cultures, their science, philosophy, and history (both good and bad), there is the opportunity for a synthesis of the better elements of each culture. Needham's work is used in this discussion as an example of the dialectical practice that could be undertaken to better understand Eastern and Western traditions. Needham uses his historical analysis as an exploration of the merits of Asian traditions of thought and philosophy, and we can use the understanding gained from this to construct a dialectic between Eastern and Western knowledge to transcend the limitations of both,

[19] Needham, vol. 2: *History of scientific thought*, p. 1.

much in the same vein as Dewey and Vygotsky's constructivist theory.[20]

NATURALISM IN NEEDHAM'S PHILOSOPHY

Needham argues that the existence of the gap between Chinese and Western traditions of thought is because the mechanist and reductionist nature of the modern Western scientific paradigm is incompatible with the ecological-holism and naturalism of neo-Confucian Chinese thought. Needham states that the reason for this was because Western thinking "lacked the background... of modern organicist philosophy".[21] The 'organicist philosophy' to which he refers is a tradition within Western thought that is still emerging, which is a naturalist philosophy based on postmodern scientific principles. Where Western science diverged with Newton and focused on mechanistic and reductionist principles, Chinese science maintained a focus on natural systems. Postmodern science in the West has had to overcome Newton's linear mechanics and undergo a fundamental change in perspective from finite particles to integrated fields in order to incorporate advances in quantum theory, whereas Chinese science was already travelling along this path, as Needham highlights:

The Chinese were so much in advance of the western world in this matter that we might almost venture the speculation that if the social conditions had been favourable for the development of science, the Chinese might have pushed ahead first in the study of magnetism and electricity, passing to field physics without going through the stage of 'billiard-ball' physics.[22]

The billiard ball is a reference to a common analogy used in Newtonian physics, and Needham shows that Western science has had to readjust its path, (unintentionally) aligning with pre-modern Chinese science. Along with this new path in science, there has been a resurgence of interest in the naturalist philosophy that incorporate field theory and associated advances in ecology and science.

This philosophy fully appreciates the naturalism and complexity of nature and that was already evident in Chinese thought and is most commonly associated with the process metaphysics of Alfred North Whitehead. Needham goes on to highlight the major elements of process philosophy and how they mirror Chinese philosophy:

> On the organic view of the world, the universe is one which simply has the property of producing the highest human values when the integrative level

[20] Michael Ford and Ellice Forman, 'Redefining disciplinary learning in classroom contexts', *Review of Research in Education*, no. 30, 2006, p. 6.

[21] Needham, vol. 2: *History of scientific thought*, p. 474.

[22] Joseph Needham, *Science and civilisation in China: vol. 4: Physics and Physical Technology: Part 1, Physics*, London, Cambridge University Press, 1962, p. 1.

> appropriate to them has arisen in the evolutionary process.... From the point of view of the scientist ... the levels of organization can be described as a temporal succession of spatial envelopes; thus there were certainly atoms before there were any living cells, and living cells themselves contain and are built up of atoms. It would, of course, be absurd to suggest that Chu Hsi and his Neo-Confucian colleagues talked like this, or even to interpret what they said as implying any of these detailed conceptions, still less to translate their words accordingly. But I am prepared to suggest, in view of the fact that the term Li always contained the notion of pattern, and that Chu Hsi himself consciously applied it so as to include the most living and vital patterns known to man, that something of the idea of "organism" was what was really at the back of the minds of the Neo-Confucians, and that Chu Hsi was therefore further advanced in insight into the nature of the universe than any of his interpreters and translators, whether Chinese or European, have yet given him credit for.[23]

This quote from Needham expresses the similarities in the organicist philosophy of Whitehead and his interpretation of Chu Hsi and the early Confucians. Needham gives credit to Chu His for his role in the absorption of Taoist and Buddhist cosmologies into the Confucian tradition, thus guaranteeing its dominance position in the Chinese worldview. Gare points out that this is similar to the way in which St Thomas Aquinas guaranteed the dominance of Christianity by absorbing and transcending the ideas of the Aristotelians.[24] What is significant about the synthesis undertaken by Chu Hsi is that it brought the organicist view to the forefront of Chinese culture, and consequently it came to be seen by the world as representative of Chinese civilisation.

It follows from this synthesis, and indeed the larger historical analysis discussed during this article, that Needham has laid the foundation for a path towards a post-Eurocentric philosophy. The first step of this is to overcome the assumption made by Hegel that philosophy has an end point. In the dialectic of traditions of thought constructed in *SCC*, Needham shows the important stages of development of Chinese thought, and by contrasting them with the Western tradition, he proposes a return to the holistic tradition of science, stemming from Song Dynasty thinkers, and was influenced by advances by Engels, and, most notably, Whitehead. His work is a demonstration of the fact that developing an understanding of the world is an active process, and that there can never be a final solution or a complete logic of the world. By understanding that the world is always in an active process of becoming, philosophy too must be seen as a process undergoing constant negotiation and redefinition. As

[23] Needham, vol. 1: *Introductory orientations*, p. 47.
[24] Gare, 'Understanding Oriental Cultures', p. 321.

such, all earlier philosophies can be seen as necessary stages along the ongoing hermeneutic path of philosophy, a point which comes across through the work of Needham. Process metaphysics engages in this dialectic with previous and current social and scientific practices, and therefore transcends unitary theories and research programs to become a way to orientate oneself in the world. It presents a philosophy that situates all humans on equal footing and provides an intellectual framework capable of mediating the way people relate to each other and different cultures. Such a philosophy has its foundations in the ecological metaphor, seeing relationships as the primary factor rather than searching for simple answers through a reductionist method. This approach aligns with the current method of post-reductionist science advanced in the work of Schrödinger Bateson, Polanyi, Goodwin and indeed Goethe. Consequently, this philosophy can become the foundations for a society of strengthened relationships different cultures, and ultimately greater appreciation for the importance of the relationship between humanity and nature.

TOWARDS A POST-EUROCENTRIC PHILOSOPHY

One barely needs to include criticism against Western culture and civilisation, as these problems are essentially universal and such criticism has been undertaken countless times in academic and non-academic texts. This being said, it is worth including a brief analysis of the phenomenon of ethnocentrism, and the flaws of the current state of Western culture, for context. Rather than listing each of the errors in Western European thought and their repercussions in current society (as this has once again been done before–and would require more than one article to list), this article will extrapolate from an example in Gare's 1993 *Nihilism Incorporated*. Gare presents a unique case where a clear comparison can be made between an autonomous civilisation prior to westernisation, and then following colonisation with the resulting current day Western society.

The account of the original Aztec capital of Tenochtitlan comes from Spanish conquistadors in 1519:

> A shining metropolis of some 300,000 people, far larger than any city in Europe, Tenochtitlan displayed immense stone temples to the gods of rain and war and an even more immense royal palace, where Aztec nobles stood guard in jaguar-head helmets and brightly feathered robes. In the nearby marketplace, vendors offered an abundance of jungle fruits and rare herbs and skilfully wrought creations of silver and gold. "The magnificence, the strange and marvellous things of this

great city are so remarkable as not to be believed".[25]

Until its fall to Spain in 1521, the Aztec empire was a quintessential example of social development in harmony with surrounding ecological systems. Aztec agriculture consisted of crops that were cultivated in such a way to obtain 7 yields annually, and thus required a smaller ecological footprint, and they subsisted on locally caught protein from the surrounding Lake Texcoco in such a way to not exhaust nearby populations, but also without the need to raise livestock (aside from turkeys). Contrast this with modern Tenochtitlan, now Mexico City, and Lake Texcoco is completely dry. In the last 40 years, more than 75% of the woodland around Mexico City has been lost, including vast parts of the Desierto de los Leones, known as the 'water forest' as it provides water for 23 million people inhabiting nearby cities. This water problem is increasingly significant, as forests are removed, water is drawn from aquafers underground, causing vast parts of the city to sink (up to 8 metres in some areas).[26] Water is not the only problem, with pollution also a major health danger (the Mexico City Government declared the air quality "bad" 262 out of 365 days in 2016) [27]. Defined as a 'megacity' by the UN, with a population over 22 million,[28] 50% live in slums under appalling conditions, many of these without any access to clean water or sewerage. The change in this city after 500 years speaks for itself, symbolising what Gare describes as "the success with which Western European civilization has conquered and subjugated almost every other civilization and culture".[29] This example demonstrates a number of clear flaws in Western European thinking, firstly, a lack of social imperative for the welfare of others, secondly, economic development at all costs, and more seriously, a lack of consideration for the ecological context in which the culture resides. And yet, despite the constant warnings and disasters that result from this mindset, there exists a fierce adherence to Western ideals, and an antagonism to perspectives from other cultures.

As mentioned above, the author is aware that criticising the shortcomings of ethnocentrism in a philosophical setting is not a new project, and criticising Western

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[25] Arran Gare, *Nihilism Incorporated: European Civilization and Environmental Destruction*, Bungendore, Eco-Logical Press, 1993, p. 1.

[26] Efraín Ovando-Shelley, Alexandra Ossa, Miguel P. Romo, 'The sinking of Mexico City: Its effects on soil properties and seismic response', *Soil Dynamics and Earthquake Engineering*, vol.27, no. 4, 2007, p. 333.

[27] Ciudad De Mexico, Calidad del aire en la Ciudad de Mexico: Informe anual 2016, Dirección General de Gestión de la Calidad del Aire, Dirección de Monitoreo Atmosférico, Ciudad de México, 2017.

[28] United Nations, *The World's Cities in 2016 – Data Booklet*, Department of Economic and Social Affairs, Population Division, 2016, p. 4.

[29] Ibid.

thought can sometimes be the proverbial broken record. This being said, Western modes of thinking are undoubtedly central to many of problems being faced on the global stage, such as the environmental crisis, the breakdown of democracy and increasing geopolitical tension. In spite of the primary role of Western thought as an actor in these conflicts, and in spite of the centuries of criticism laid against western modes of thinking, the research being undertaken in philosophical institutions around Australia (and around the world), still predominantly prioritises the Western tradition over Eastern philosophy. The flaws in this approach are highlighted by Ian McGilchrist, who states that western philosophy is more positivistic, seeking one-dimensional, compartmentalised answers, based on individual and often abstracted components. The result of this positivism is that one perspective is taken to be superior to another, as there may only be one answer may be correct, with other perspectives deemed incorrect or irrelevant. He notes that this is in contrast to eastern philosophy, which are more likely to use a dialectical mode of reasoning, focusing on the relations between objects and with their context.[30] McGilchrist says that this latter philosophical tradition is "more willing to accept, to entertain, or even seek out contradictory perspectives on the same issue. They see the world in which they live as complex, containing inherently conflicting elements".[31] Where the positivistic mindset seeks to determine which idea is correct in order to eliminate other options, the methodology of dialectics attempt to unify opposing perspectives by synthesising them into one idea.

Although Needham never explicitly argued for a combining of Western and Eastern ideals, his analysis allows for such an informed dialectic. This means that instead of prioritising one perspective over another, all cultures and peoples are positioned on the same level. This permits such a dialectic as described by McGilchrist and constructs the potential for a post-Eurocentric philosophy that fosters genuine understanding and friendliness across all peoples and all civilisations. Whitehead explains the implications of this:

> [A] philosophic outlook is the very foundation of thought and of life. The sort of ideas we attend to, and the sort of ideas which we push into the negligible background, govern our hopes, our fears, our control of behaviour. As we think, we live. This is why the assemblage of philosophic ideas is more than a specialist study. It moulds our type of civilization.[32]

In essence, by providing an objective framework of thought that enables a true

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[30] Ian McGilchrist, *The Master and His Emissary*, London, Yale University Press, 2009, p. 455.
[31] Ibid.
[32] Alfred North Whitehead, *Modes of thought*, New York, The Free Press, 1938, p.63.

understanding of each other's cultures and histories, this philosophy creates the conditions to mould society into one based on mutual recognition. This is important because the greatest evil of Western imperialism and the Eurocentric philosophy was a lack of recognition, a blindness, to the intelligence and autonomy of others' cultures. This is well framed by Klaus Krippendorff:

The issue is not to understand others but to understand the understanding of others as manifest in what they say and do. Understanding others' understanding, understanding understanding, is of a logical type quite different from understanding objects that are incapable of understanding.[33]

Instead of understanding other cultures' capacity for understanding, Western imperialist ideology has been demonstrated to only recognise land and people for their utility value. The results of this are well known: slavery, war and environmental collapse. Any ideology that results in these sorts of actions must be reassessed and replaced with one that fosters mutual understanding and recognition between cultures.

Needham's work in *SCC*, and his many other essays, have contributed in a vast way to foster this recognition. His insights in the macrosociology of power, knowledge, and socio-economic formation have shed a light on the similarities between Eastern and Western development. In doing so, he has contributed to the process of liberating Chinese thought from the patronising imperialism of Western domination and bringing it to the forefront of contemporary consideration. This is important not just for the liberation of Eastern thought, but also for the salvation of all humanity.

It may be that scientism, the idea that scientific truth alone gives understanding of the world, is nothing but a Euro-American disease, and that the great contribution of China may be to save us from the body of this death by restoring humanistic values based on all the forms of human experience.[34]

As well as these humanist values, what emerged over centuries of Chinese history was a remarkable tradition of unobtrusive observation of nature, both of which culminated in a comprehensive and considered cosmology.

The Chinese world-view depended upon a totally different line of thought. The harmonious cooperation of all beings arose, not from the orders of a superior authority external to themselves, but from the fact that they were all parts in a hierarchy of wholes forming a cosmic pattern, and what they obeyed were the internal dictates of their own natures. Modem science and the philosophy of organism, with its integrative

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[33] Klaus Krippendorff, 'The dialogic reality of meaning', Poiesis: *The American Journal of Semiotics*, vol. 19, no. 1, 2003, p. 23.

[34] Needham quoted in Sal Restivo, 'Obituary: Joseph Needham, 9 December 1900-24 March 1995', *Social Studies of Science*, vol. 26, no. 1, 1996, p. 8.

levels, have come back to this wisdom, fortified by new understanding of cosmic, biological and social evolution.[35]

As we face global environmental catastrophe, what is needed is a more ecologically-considered naturalism, an idea that Needham suggests is inherent to Chinese philosophy. Arguably, these elements are absent from the Eurocentric philosophy, and thus the synthesis of Eastern tradition with Western thought could offer enlightenment with the introduction of these ideas. Indeed, Needham was adamant of this fact, and throughout *SCC* he often uses the Latin phrase *ex oriente lux*, meaning "light comes from the east". Needham's work enriches philosophy as a whole by avoiding the idiosyncrasies inherent to conceiving the world from the point of view of one culture or geo-social context. Building on this, philosophy can benefit from understanding the achievements and limitations of all other cultures, both past and current, as Needham himself has done. While this task can never be perfectly complete, the process of critical reflection on one's own culture and the consideration of the strengths of other cultures has immense potential to overcome the flaws in the current Western culture.

NEEDHAM AND WHITEHEAD'S CONTRIBUTIONS TO A POST-EUROCENTRIC PHILOSOPHY

Needham's work holds great value for understanding Chinese philosophy and the deficiencies in the Western tradition, and his massive, multi-volumed study presents the most substantial basis for reconciling Western and Chinese thought. His work was partly inspired by the philosophy of Whitehead, a tradition that also attempts to give a place to the thinking and values characteristic of Chinese philosophy. Needham's combination of Whitehead's philosophy with his own historical analysis is particularly fruitful, because Whitehead essentially provides a vehicle for Needham's insight. Whitehead's process metaphysics is a philosophy for conceiving of the world as undergoing constant change. What this means in the context of Needham's work is that the current state of Western Culture is not a concrete fixture, nor is it even a historical endpoint, it is undergoing constant change and redefinition, and thus there is the potential to channel this transformation along a less destructive path. By uniting Needham's work with Whitehead, the lessons learned from the rise and fall of Chinese history can be applied to a reflection on Western European culture to focus the way that we conceive of the world. Thus, the solution to avoiding the idiosyncrasies of the cultural solipsism inherent to Eurocentrism is offered by Needham and Whitehead in

[35] Needham, vol. 2: *History of scientific thought*, p. 582.

the form of a post-Eurocentric metaphysics that demonstrates a critical perspective capable of comprehending the history and achievements of other cultures, both current and past. The value of stepping outside one's culture is demonstrated by Edward Said:

> The more one is able to leave one's cultural home, the more easily is one able to judge it, and the whole world as well, with the spiritual detachment and generosity necessary for true vision. The more easily, too, does one assess oneself and alien cultures with the same combination of intimacy and distance.[36]

Said's point supports the value of developing an alternative metaphysical system that distances oneself from and challenges the presupposed assumptions and power relations. It is not simply a matter of replacing one set of ideals with another, but instead, as Whitehead argues, it is about constructing a mode of being and engaging in the world. Instead of changing ideas, rather changing the metaphysical system will allow for the possibility of altering the way people live in the world. By providing concepts that can mediate people's engagement in practices and institutions in new ways they have the potential to become the foundations for new social formations. This allows for a mode of being that actively revaluates the world and constructs different outcomes for society and our relationship with nature.

CONCLUSION

There is no doubt that Needham's monumental work, *Science and Civilisation in China*, laid the epistemological foundation for a comprehensive study of Chinese science, technology and philosophy throughout Chinese history. More importantly, he provides a critical and analytical evaluation of the organisation and development of scientific progress and intellectual traditions both in China and the West. This is an essential step in developing his philosophy in a global perspective, as Needham demonstrates an example of the kind of cultural understanding that underpins transcultural recognition. This recognition is part of Needham's overall vision of a genuine and earnest friendliness among all cultures and civilisations throughout the world, a friendliness based on mutual acknowledgement and the appreciation of a culture's levels of intellectual and technological development.

Needham's work is often criticised for its Marxist influence, but as mentioned above, Needham went to great lengths to reveal all of the elements that contributed to

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[36] Edward Said, *Orientalism: Western conceptions of the Orient*, New York, Penguin Classics, 2003, p. 259.

the development of science in China. It goes without saying that the socio-economic factors are important, but Needham uncovers an immense amount of information also surrounding the religious, political and cultural factors. This not only contradicts the criticism laid against Needham for being a Marxist, it also underlines the immensely comprehensive effort undertaken by Needham to detail all elements of Chinese history of science. The other major element to emerge from Needham's work is the potential for a philosophy with a greater appreciation for the biosphere, one that builds on the organicism of neo-Confucian and Taoist philosophies along the lines of Whitehead and others. Needham brings to the forefront the naturalism that is inherent to these perspectives and demonstrates that it is possible to have a dominant culture within a society that is founded on an understanding of the integrated relationship between humanity and nature. Needham's work constitutes a prototype for developing a contemporary philosophy with a more adequate appreciation for life and the environment.

As Said highlighted above, addressing the present global situation requires the appreciation of diverse and differing cultures, a task that is only possible through the act of stepping outside your own culture. This action is the basis of Needham's philosophy and is the foundation for his post-Eurocentric philosophy. It should be noted that this task is never perfectly achieved as the embedded metaphysical assumptions of one's civilisation always inevitably return. These assumptions cannot be avoided, but they can be employed to construct the foundation of a positive comparative philosophy, in the same way that Needham reflected his research in *SCC* back against his training in the Royal Academy, and in doing so, achieved a dialectic with greater depth and perspective. Most importantly, this metaphysical system comes to terms with the complex social organisation of the world, and how it can presently be understood. It provides a critical perspective on the present era, the metaphysical assumptions which underlie it, and the path towards a united future. The argument can be made that this sort of recognition is certainly absent in the global situation. In an age where fear and the lack of understanding are the default foundation of relations between cultures, nations, and religions[37], the construction of a complex comparative philosophy based on facilitating understanding is required. This is also particularly relevant for European or American understanding of Islam. It is unclear whether the present hostility towards Islam actually stems from ignorance, or is simply another form of power relations manifested as a modern Orientalism, but on the street level this can

[37] Douglas Pratt and Rachel Woodlock, *Fear of Muslims? International perspectives on islamophobia*, Cham, Springer, 2016, p. 31.

be combatted with the dissemination of a post-Eurocentric philosophy facilitating understanding and recognition of the diversity of cultures. Needham says that this task "today means accepting all men everywhere on the basis of absolute equality and fraternity, and seeking justice everywhere for all human needs. Only then will all other things be added — even the change of a future for all".[38]

The prospects for the future of Needham's philosophy now require urgent consideration. It is hoped that the development of this greater understanding and acceptance between different people and cultures will free all societies from the Eurocentrism that imposes Western thinking and Western ideals on Eastern and other non-Western civilisations. This goes beyond battling or subverting European narratives. These narratives need to be transcended entirely through the construction of an overarching philosophy that considers and appreciates the history, stories and autonomy of all cultures. *Science and Civilisation in China* was the prototype for this process, going beyond the European perspective and recognising the achievements and the failures of Chinese society. Needham's work provides a powerful starting point for developing a post-European philosophy for a more harmonious global perspective.

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[38] Needham quoted Gregory Blue, 'Joseph Needham, heterodox Marxism and the social background to Chinese science', Science & Society, vol. 62, no. 2, 1998, p. 201.

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