The Dialogue of Civilizations in the Birth of Modern Science (review)

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fort to facilitate understanding (one thinks of B. K. Matilal, J. N. Mohanty, and others in this regard). Thus, an account of the Advaitic sāksin may include a discussion of Husserl’s transcendental ego or Sartre’s prerelective consciousness, or an account of the Yogācāra view of consciousness as having a form might be contrasted with G. E. Moore’s account of consciousness as diaphanous.

Similarly, describing the sense in which, say, Yogācāra can be characterized as idealist, Nyāya as realist, Advaita as non-realist, et cetera, has become a widespread practice in recent works. The comparisons serve to provide a context that increases understanding and suggests new avenues of research. And while Timalsina is certainly under no obligation to engage in comparative philosophy—or, for that matter, to reach scholars unfamiliar with but interested in Indian thought—it is clear that the fruits of the current study and the author’s command of the material have much to offer in this connection, and it would be most welcome to see future researches by Timalsina engage the variety of issues addressed by contemporary cross-cultural philosophical studies.


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When I first encountered Indian philosophy after having studied Western philosophy, two examples of comparative interest caught my attention. One was Saussure’s theory of meaning through difference (which led to the vibrant traditions of structuralism, poststructuralism, and postmodernism). I was immediately struck by the stark similarity between this theory and the Buddhist apoha theory of meaning. The other example was that of Hume, and in this case I was amazed at the sophistication of the Indian philosophical discussions on the problem of induction compared to which Hume’s analysis was quite pedestrian. My encounter with both these issues illustrated two problems in the history of ideas. In the case of Saussure, I wondered whether he had any inkling of the apoha theory and whether that theory had any influence in his formulation. Given that Saussure was a Sanskritist this question is not only relevant but also necessary. This is primarily a problem of origin of ideas as well as of proper accountability. In the case of Hume, the problem is that philosophy around the world is taught as if Hume is the first and last word on the problem of induction and causality. A cursory look at Indian philosophy will immediately dispel any such belief, and in fact suggest a contrary picture, yet this practice of not acknowledging the intellectual contributions of other civilizations continues. There are too many examples like these two and this fact demands an explanation.

It is against this background that I read _The Dialogue of Civilizations in the Birth of Modern Science_ by Arun Bala. This book engages with similar issues but in the context of the origin of modern science. It succeeds in addressing these questions in a far more sophisticated and rigorous way than I would have thought possible.
and in so doing illuminates many important elements of the nature of knowledge itself.

Very often, when questions about the origin or priority of ideas are raised a standard response is often one of suspicion. Why should anybody be interested whether science or at least the idea of it was available to ancient civilizations? And when somebody raises these questions, what are they after? Do they want an acknowledgment that different civilizations had the intellectual capacity for science and in this way claim a kinship with the intellectual tradition of Europe, which has come to define the standards for the rest of the world? Or worse, do they want to appropriate a value essentially associated with Europe to other cultures such as the Arabic, Chinese, and Indian?

The reason why anybody should be interested in these issues has as much to do with the nature of knowledge as with the way societies are shaped in contemporary times. Under the influence of the dominant paradigms of the Western Enlightenment, generations of students in Asia, Africa, and the Middle-East have been taught that the most important marker of intellectual thought—that of modern science—was a special creation of the European imagination. Alongside this claim, there is another more contentious claim: that other cultures not only did not create modern science, but for various reasons they did not have the capacity to do so. If one thinks that these observations are exaggerations, all they have to do is to look at the content of textbooks and the sedimentation of the belief that Western civilization is fundamentally superior to other civilizations when it comes to modern science (and philosophy, too, for that matter). The impact of such indoctrination on the self-confidence of non-Western cultures cannot be underestimated.

Given this situation it is not a surprise that there have been knee-jerk reactions to these claims of the West’s special relationship with science. One trend is to attack the project of science itself and point to the disastrous consequences of modern science. Another trend is to show how other civilizations ‘had’ science (and technology) to varying degrees. The examples of Indian and Chinese technological innovations, as well as their mathematical and scientific heritage, have been well documented in the literature. Faced with this information, the uniqueness associated with Europe was shifted to the origin of modern science. This led to the concomitant question of why other cultures did not develop modern science and is famously reflected in Joseph Needham’s question as to why modern science developed in Europe and not in China (or elsewhere).

Bala begins by unpacking the assumptions inherent in this question. He first suggests that this question itself indicates an assumption about the universality of modern science since other ‘local’ traditions of knowledge are not considered as science. Second, there is an assumption that Greek ‘science’ is organically linked to modern science; hence, a similar question about the origins of modern science is not posed to the Greeks as it is to the Chinese or Indians. Third, this question is predicated on the belief that other non-Greek cultures made no contribution to the development of modern science. So in the dominant narrative of the creation of modern science, not only is an artificial link to the Greek tradition discovered but there is, at the same
time, an erasure of the links to the Arabic, Chinese, and Indian contributions. Bala’s book is a sustained and careful criticism of these beliefs and is an illuminating account of how multicultural processes were integral to the origin of modern science.

The Eurocentric view of science understands science as a unique byproduct of European civilization. In contrast, Bala suggests a dialogical approach that is based on an acknowledgment of the multicultural contributions to the origin of modern science as well as an acknowledgment that it was indeed a unique creation by the Europeans (p. 26). He first begins by considering how multicultural histories of science naturally arise if the date of the origin of modern science is shifted backwards, as was indeed done by Duhem (chapter 4). Duhem’s argument that the origins of modern science should be traced back to the fourteenth century allows Bala to make an explicit connection between the influence of Arabic and Chinese cultures on Europe that was quite prominent in the medieval ages.

Most influential writers, even if they had been aware of the contributions of other cultures to science, mathematics, astronomy, and technology, resist accepting the influence of these cultures on modern science. The real challenge to the multicultural history of science rests on ‘evidence’ for the transmission of ideas from other cultures into Europe prior to the period of modern science. As Bala points out, even Needham’s argument for the influence of other cultures is based primarily on the recognition that some of these ideas originated in China earlier and not on any historical evidence of transmission of these ideas from China to Europe (p. 42).

What evidence do we have that ideas, concepts, and techniques did indeed migrate from one culture to another, especially if the culture that has received these ideas does not see it as necessary to acknowledge this? Bala carefully considers grounds that warrant claiming which ideas, prior in origin, influenced ideas in Europe by isolating the notion of thematic influence. One criterion that he uses is that if an idea had not been taken seriously in Europe until Europeans recognized it as a dominant theme in another culture and that led them to convert it into a “major theme in modern science, then we have to concede influence” (p. 47). Drawing on Holton’s notion of ‘ideational themes’ that pointed to thematic influences in science, Bala suggests that we can make better sense of the question of transmission by looking at thematic influences.

Bala notes that this criterion is a sufficient condition for accepting transmission. He is also aware that European histories do not make an explicit acknowledgment of such transmissions, but then the historical writing of Europe is a rewriting that consciously “ignored the multicultural influences on Europe” as well as the dialogical process with other cultures. However, in making this argument, Bala does not want to claim copyright over modern science on behalf of other non-European cultures. The dialogical argument, built around thematic influence, accepts that the development of modern science is a unique European achievement, but it was first of all made possible by the transmission of ideas from other non-European cultures.

In the remaining eight chapters, Bala sets out to support his argument with countless examples. Much of it has to do with examples of the influence of conceptual ideas from Arabic, Chinese, and Indian cultures on Europe. This material is so rich
and nuanced that it will be difficult to discuss this in any detail in this review. Let me list out only a few important influences.

First, the Renaissance in Europe is often seen as a rebirth of Greek thought and does not acknowledge the influence of other cultures. Bala discusses the seminal influence of both Arabic and Chinese cultures leading up to the Renaissance, an influence best exemplified by da Vinci. The curricula of the University of Padua followed that of Arabic institutions; the fact that this university was to become the alma mater of Copernicus, Galileo, and Harvey points to the indirect influence of Arabic thought on these influential figures. Numerous Arabic works in medicine, astronomy, and optics were translated from the tenth century onwards, thus becoming available to European thinkers. The European response toward these translated works was conditioned by their attempt to link themselves to Greek thought and thus allowed them to interpret Arabic culture “as a mere carrier of ancient European thought” (p. 59). (Contrast this with the Arabic scholars who meticulously described their debt to India and China.) Bala argues that as a consequence, the Europeans “invented the doctrine of a dark age that intervened between New Europe (the West) and Old Europe (the Hellenistic world) to facilitate the assimilation of Arabic scholarship into medieval Europe” (p. 60).

He then goes on to consider the Copernican revolution, which in standard accounts of modern science stands as the originary event. First of all, as Bala points out, variations on heliocentric theories had been formulated by the Greeks as well as by the Indians. Moreover, Copernicus’ rejection of Ptolemy involved new uses of trigonometry as well as the rejection of the equant. Bala points out that Copernicus inherited his methods in trigonometry from the Indians and the rejection of the equant from Arabic astronomers (p. 67). The Indian place-value number system along with zero made possible the computations by Copernicus. Indian mathematicians, who had developed proto-theories of calculus, solutions of quadratic equations, and so on, profoundly influenced Arabic scholars. Vasco da Gama’s arrival in Kerala (where these early theories of calculus were taught) in 1498 opened a corridor of communication to Europe. Following the criterion of thematic transmission we can explain the sudden emergence of these Indian ideas in Europe by the simple fact that these ideas were transmitted from India to Europe. For example, a book for students called Yuktibhasa, on the work of the Kerala astronomy school, which described various themes associated with calculus, was available to European missionaries. This book contains ideas that predate by nearly half a century the emergence of similar ideas in Europe.

Similarly, there was a long tradition in Arabic astronomy that developed a critique of the use of the equant in Ptolemy. It was also discovered that the “solar, lunar, and planetary models of al-Shatir are mathematically identical to those proposed by Copernicus some 150 years later” (p. 83). The similarity between Copernicus and the earlier Arabic Maragha School has led to the observation that “Copernicus can be looked upon . . . as the most noted follower of the Maragha School” (p. 83).

The optical revolution, which played a major part in the development of modern science, was significantly influenced by Alhazen’s work on optics. It influenced Grosseteste, Roger Bacon, Galileo, and Kepler. Alhazen’s theory of vision had a sig-
nificant impact on Europe with two profound consequences: it catalyzed a shift toward mathematical realism that was instrumental in influencing the way in which mathematics gets to be ‘applied,’ and it created a “profound shift in the perceptual sensibilities of Europeans” (p. 91).

The theory of atomism also had an important role in the origin of modern science. Here again Bala convincingly argues about various traditions of atomism in other cultures and the influence they had on other categories, particularly that of necessary relations. He also points out here that Hume’s critique of causality parallels that of the earlier al-Ghazali; historians have noted that even some examples given by Hume are the same as those given by al-Ghazali (p. 106). All these arguments challenge the view that modern science is organically related to Greek science. After having demolished this claim, Bala in the remainder of his book goes on to argue for the multicultural basis of modern science.

The Arabic tradition built upon, synthesized, and developed Indian, Chinese, and Greek scientific and philosophical traditions. In the narrative of the origin of modern science, all these influences (except the Greek) are discarded. Needham suggests that the reason why Indian and Chinese contributions were ignored was due to the selective choice by European translators, who ignored the Arabic texts dealing with India or China.

Bala goes on to argue that the “fusion of the concept of a universal mathematical law with the notion of a mechanical law is the outcome of the meeting in Europe of Arabic philosophy and science with Chinese mechanical discoveries” (p. 122). This mechanical philosophy greatly influenced Harvey, whose theory of the circulation of blood and the model of the heart as a pump laid the foundation for modern medicine. Given that the Chinese had a well-established theory of the circulation of blood and a model of the heart as a pump, and that the European engagement in China was already a century old, could it have been possible that Harvey’s ‘discovery’ was actually influenced by literature transmitted from China? While this does not negate original European contributions about the mechanical picture of the world developed in modern science it is nevertheless the case that this picture itself was influenced by Chinese theories (as well as the medical literature of the Arabs).

Bala then continues this sustained critique by showing how many other fundamental concepts that influenced Brahe, Kepler, and Newton, among others, were based on ideas derived from non-Western sources. In a sense, the real revolution in the creation of modern science is this bringing together of diverse ideas from many cultural sources with different philosophical and scientific worldviews. As Bala reiterates, this is not to deny the uniqueness of the scientific revolution in Europe. Such a multicultural perspective on the origin of modern science also helps Bala to explain why modern science began only in Europe. If the possibility of modern science lies in the confluence of ideas from Arabic, Chinese, Indian, and Egyptian cultures along with the Greek, then it is only in Europe that such a confluence would have been possible. This ‘geographic’ explanation of the origin of modern science in Europe sounds far more reasonable than many ‘cultural’ explanations that are based on unacceptable stereotypes of other cultures.
Accepting his argument also entails a different take on the science wars. Much of this conflict is fought on spurious grounds that invoke artificial oppositions between science and superstition, science and ideology, science and religion, and so on. It has also degenerated into claims of the superiority of one kind of reason and rationality, even as it places the capacity to be agents of such rationality solely within the European Enlightenment tradition. While doing so, it negates the creative and critical capacities of not only other cultures but also other non-scientific communities within these cultures. Accepting the multicultural origins of modern science will significantly change the contours of these battles. Bala’s argument also has serious implications for science debates in non-Western countries, particularly for the conflict between science and indigenous knowledge. If Bala is correct, then indigenous knowledge was an essential part of the creation of modern science, and so modern science cannot be used to “sharply sunder the intellectual history of the West from the Rest” (p. 3).

Are matters of priority really important? Definitely—at least if we believe in the virtues of modern science. The history of modern science is filled with claims and counterclaims to priority. The institutionalization of science valorizes priority and rewards the first discoverer and inventor. Scientific publication is very much about being the first to publish a result. The intensely strong reaction against plagiarism is related to this obsession with priority. It is ironical, then, that given such meticulous attention to priority in modern science, proper acknowledgment of priority is not given to the birth of the discipline itself!

This book will also be very useful to those who want to construct similar arguments about intellectual ideas in the fields of philosophy, art, literature, and so on. In all these cases it is not a matter of priority alone but also of recognizing that in choosing one dominant paradigm (that of the West), a majority of the world’s population is losing access to very different views about the world, the cosmos, and our own place within it. And it is very possible that it is within these differing traditions and worldviews that the future of humanity is to be secured. Even if the West chooses not to build upon the insights in this book, at least the Rest should be made to read it!


Reviewed by Ian M. Sullivan University of Hawai‘i

Expanding Process: Exploring Philosophical and Theological Transformations in China and the West, by John Berthrong, is a model study of processive motifs in Chinese traditions and their contributions to global process-relational philosophy. Process-relational philosophy, which became a full-fledged school of thought in the twentieth century with the works of Alfred North Whitehead and the American Pragmatists, conceives of reality as constant flux. This metaphysical view is opposed to