Translating the "Exact" and "Positive" Sciences: Early Twentieth Century Reflections on the Past of the Sciences in India

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The concept of science is a singularly powerful, normative, and dominating one in the Anglophone world.[1] In the nineteenth century, with the institutionalization of disciplines under the organizational rubric of the university, "science" came to connote not just a body of knowledge, but also referred to a prescriptive protocol for making scientific discoveries. Equally, by the middle of the nineteenth century, through William Whewell's writings, the term "scientist" came to represent an individual pursuing science in a focussed manner, and has stayed with us since (Ross 1962; Whewell 1847). Interestingly enough, Niklas Luhmann once pointed out that while the modernity of modern society or art are still debated, that of science is not considered worth questioning (Luhmann 2002). Perhaps this explains how rapidly the term began to acquire the intimations of a cultural universal. This big picture of science pinned on the frame of cultural universality did not fracture into a jigsaw of sciences until the last decades of the twentieth century (Galison 1996). By then, the term had come to designate a plurality of epistemic and institutional cultures, and often enough epistemically distinct constellations of knowledge, at least after the middle of the twentieth century. This paper does not historicize the globalization of the term "science" in nineteenth and twentieth century Europe. Rather it explores the naturalization of the term in late nineteenth century Bengal, and the different meanings and objects that the term came to designate as it came to be qualified as "exact" or "positive." In order to do so it does not turn to an archive of scientific papers on physics or geology, but to the meta-narrative of the history of science. This choice is not an arbitrary one as "scientist" and "historian" were one and the same until the history of science began to acquire a separate disciplinary identity in the 1920s (Thackray and Merton 1972). At least until the work

1 The first version of this paper was presented at Heidelberg University's seminar "Global Concepts? Keywords and Their Histories in Asia and Europe," organized by Monica Juneja, Joachim Kurtz and Susan Richter in January 2011; modified versions were subsequently presented at CRASSH, Cambridge University and Dalhousie University, Canada in 2014. I thank Simon Schaffer for his suggestions on the Whewell-Mill debate.

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of Pierre Duhem and Paul Tannery the history of science was part of the contemporaneous practice of science and not a mere reflection on its past (Brush 1995; Laudan 1993).

This paper attempts a social epistemological understanding outlined in an earlier paper in order to explore how the term "science" was qualified in colonial India (Raina 2009). Post-colonial theorists, anthropologists, sociologists, historians, and philosophers of science have raised salient concerns regarding the virtual impossibility of transcending the "hermeneutic circle" defined by the colonial experience. In as much as post-colonial theory of science destabilizes the representation of the Orient in social science theory, it represents one version of cultural production in the social sciences. The central question addressed here is how did Indians writing in the early decades of the twentieth century construct Indian knowledge systems as positive or exact and what did they mean by the term "science"?

Towards the last decades of the nineteenth century, Indians began to write histories of the sciences in English (Raina 2003). In this paper I take up the discussion around three books published from Kolkata in the first decades of the twentieth century; these being *The Positive Sciences of the Ancient Hindus* (1915) by Brajendra Nath Seal (1864–1938); and *Hindu Achievements in Exact Sciences* (1918) and *The Positive Background of Hindu Sociology* (1921) by Benoy Kumar Sarkar (1887–1949). These books were published during the period of late colonialism when a new national consciousness seeking to liberate itself from colonial rule had begun to first orchestrate itself (Sarkar 1975). Both figures were associated with the National Council of Education, an educational movement that sought to oppose the agenda of colonial education (Raina and Habib 2004). Colonial education drew its legitimacy from the legacies of science and the social sciences, which became instruments not just for civilizing the colonized but also for resolving the central problem of colonial governmentality (Kumar 1991). As the first generation of Indian cultural amphibians entered the modern educational system they were prompted to produce a "reverse commentary" (Kaviraj 1993). It could be argued that the notion of science framing these early works on the history of sciences in South Asia was the dominant one in the philosophy of science discourse in the West, namely that which was presented in two contemporary master narratives authored by John S. Mill (1806–1873) and William Whewell (1794–1866)—these being Mill's *A System of Logic* (1843) and Whewell's *History of the Inductive Sciences* (1847).

Returning to the works of Sarkar and Seal, two points need to be emphasized. The first is that their books could be read within the context of the reception

of Western social science and history introduced through the educational system of the colonial state in India. This manner of reading is familiar to historians of science. Secondly, while these texts attempted to reconstruct the history of the natural and social sciences in India respectively, they were also responding to Western representations of Indian knowledge systems. While contesting Western representations of Indian knowledge systems, these texts worked within representations of the sciences of the West. In other words, the problem here lies at the interface of canonical representations of the social science disciplines in the West and the response of South Asian scholars to these representations towards the end of the nineteenth and early decades of the twentieth century.

The positive and the exact sciences

Let us turn first to the work of Benoy Kumar Sarkar since it provides us with an understanding of what the received meaning was of a positive science. Ideas about positivism amongst the Bhadralok community in Kolkata date back to the 1860s—positivism having reached India through the efforts of the British positivists such as Richard Congreve. As has been pointed out by Geraldine Forbes and Jasodhara Bagchi independently, positivist religion was first welcomed by the Bhadralok class since they saw in it a role for themselves in the social transformation of society—the influence of positivism, like in other contexts, was manifest in the attempt to integrate it with a reformed Hinduism (Forbes 1975). In addition to positivist ideas, certain Spencerian notions had also acquired currency for it was felt that the Western-educated Indian class, small though it be, would and could play a central role in initiating social progress (Kumar 1991).

Benoy Kumar Sarkar was considered an influential cosmopolitan scholar in his time but has since become, as Roma Chaterji writes, a footnote in the history of Indian sociology, who is rarely taught, if at all, in Bengal (Chaterji 2007). In 1918 he published *Hindu Achievements in the Exact Sciences* (hereafter *HAES*), one among his few slim volumes, which was based, unlike the work of Seal discussed below, on the secondary literature produced by British Indologists, a burgeoning community of Indian historians, and European historians and philosophers of science.[2] The work attempted a comprehensive account of science in ancient and medieval India by establishing the "chronological

2 Curiously enough, Whewell figures prominently in the references and citations in Sarkar's book and Mill does not, while in Seal's work Mill figures but Whewell does not. Both Seal and Sarkar would have known the works of Mill and Whewell, but Seal was more philosophically inclined than historically although, like Sarkar, he repeatedly called his method "historico-comparative"

links" and "logical affinities" between the scientific investigations of the Hindus, Greeks, Chinese, and Saracens (Sarkar 1918, v). In other words the history of science was about the history of transmissions embedded within a theory of epistemological correspondences. This work, produced during the rising tide of the nationalist struggle, sought to redress the paucity of literature on the history of Hindu and Chinese science, and in doing so "the students of comparative culture-history could find that the tendencies of the Oriental mind have not been essentially distinct from those of the Occidental mind" (Sarkar 1918, v–vi). Seal's work had provided the source material on the methodological premises of the sciences in India. The chapters on the different sciences in Sarkar's book are preceded by one entitled "historical perspective," which is of concern to this paper rather than the content of the subsequent chapters. The chapter celebrates the discovery of radioactivity and the possibility of envisaging an age where the mastery of the atom would provide energy for "cosmical epochs of time" (Sarkar 1918, 1). The optimism, we are informed, surpassed that of Francis Bacon who had first advocated the experimental and inductive methods. But the important point to note is that while the exact sciences could be deductive-mathematical or inductive-physical it was the Commonwealth of Nations that had contributed to their growth and development (Sarkar 1918, 2).

Recognizing that positive science was about three hundred years old, it was equally important "to remember this picture of the intellectual condition of Europe at the beginning of the seventeenth century in every historical survey of the 'exact' sciences (whether deductive-mathematical or inductive-physical), as well as in every comparative estimate of the credit for their growth and development due to the different nations of the world" (Sarkar 1918, 2). In other words, he was suggesting that comparisons were to be chronologically synchronous. Since the contents of his book relate to an epoch of science considered pre-scientific, the merit of the argument could only be estimated against the backdrop of parallel developments amongst the Greeks, the Chinese, the Greco-Romans, and the Saracens (Sarkar 1918, 3). In the Indian case, Sarkar, drawing on the work of Seal, who figures in his bibliography, pins down so-called investigations in exact science from the period 800 BCE to 1400 CE; his examples include the work by the mathematician Bhāskaracharyā (c 1150) and that of the logician Gunaratna (1350), the work on chemistry "Rasa-ratna-samuchchaya," and Madanapala, the author of one the important texts on *materia medica* (1374) (Sarkar 1918, 3). Sarkar does not offer a definition of what he means by the exact sciences, but the reader is left to infer from the choice of historical texts and authors that it includes mathematics, astronomy, logic, and those disciplines involving weights and measures.

The rupture or break separating the pre-scientific, viz. the scientific inquiries of the ancients and medieval, and the modern sciences lay in the fact that the former produced, according to Whewell as quoted by Sarkar, "no truths of real or permanent value." This, Whewell went on to elaborate in his *History of the Inductive Sciences*, was because the whole of pre-modern science displayed

> extreme ingenuity and subtlety, invention and connection, demonstration and method, and yet out of these no physical science may be developed. We may obtain by such means logic and metaphysics, even geometry and algebra; but out of such materials we shall never form optics and mechanics, chemistry and physiology (Whewell, quoted in Sarkar 1918, 3–4).

In other words the methods of the pre-moderns led to scholasticism and they could not have produced exact sciences such as optics or mechanics, or positive sciences such as chemistry and physiology. In broad agreement with Whewell's thesis that the pre-modern-modern break was accounted for in terms of the invention of a new method, Sarkar flagged several points of disagreement. Firstly, the discipline of pure mathematics in India was fairly advanced in antiquity and the middle ages and had anticipated the European discoveries of the sixteenth to eighteenth centuries, and this mathematics could well have been the basis for the mathematical sciences (Sarkar 1918, 4). The grounds for this inference came from the writings and translations of astronomical and mathematical manuscripts by British Indologists such as Henry Colebroke and their subsequent integration into the histories of mathematics such as those authored by Florian Cajori (Colebroke 1817; Cajori 1909).[3] One marker of the distinction between the exact sciences and positive sciences in this work is a historical departure in the development of the sciences that dated back to the seventeenth century. The contributions of Hindu science were not merely restricted to the exact sciences, but to the positive sciences, though it is possible that they did not influence the development of modern science in the same manner as did the exact sciences. The discussion is often marked by indigenism, given that these interlocutors were writing against the grain of the narratives of Oriental indebtedness to the Greek tradition. Thus Sarkar readily admits that while writing was received as in other civilizations from the Phoenicians, and that Varahamihira's astronomy reveals Greek and Roman sources "India's indebtedness to foreign peoples for the main body of

3 Sarkar mentions Colebrooke's appreciation of Bhaskara's demonstration of the Pythagorean theorem, the general solution to indeterminate problems of the first degree, and the solution to indeterminate problems of the second degree; the first of these solutions anticipating, according to Colebrooke, the work of John Wallis in the seventeenth century; the second that of Claude Gaspard Bachet de Méziriac in 1624 and Leonhard Euler (Sarkar 1918, 15–16).

her culture has been virtually nil" (Sarkar 1918, 5–6). This radical alterity is needed in order to stage the central inference that the

> Hindu intellect has thus *independently appreciated* the dignity of *objective facts*, devised the methods of *observation and experiment*, elaborated the *machinery* of *logical analysis and truth investigation*, attacked the external universe as a system of *secrets to be unravelled*, and wrung out of Nature the knowledge which constitutes the foundations of science (Sarkar 1918, 6) (emphasis added).

The passage is replete with markers of indigenism as well as images of a triumphant Baconian science that are projected onto the past.[4]

The methods of observation and experimentation in the sciences of ancient and medieval India had been elaborated upon in the book of Seal; and Sarkar repeatedly turns to Seal's work (eight times in his book) to justify several of the historical claims in favour of the scientificity and mature stature of Indian science. If this was the nature of science on the subcontinent then the Hindus too were "pioneers of science and contributors to exact, positive and material culture; which meant that no superiority could be claimed either for Greece or India nor could any fundamental differences in mental outlook, weltanschauung or vision be demonstrated between the two civilisations" (Sarkar 1918, 6).

The qualification of the sciences or the achievements thereof as Hindu has itself been a matter of scholarly discussion: whether the elements of a proto-Hindu cultural nationalism were cobbled together at this time (Zachariah 2011), or whether the terms Hindu sciences or Hindu mathematics were merely taken over from British Orientalists to refer to the Sanskrit textual tradition. The science histories of Prafulla C. Ray and Seal do not qualify the term "Hindu," while Sarkar in several places underlines what it does not mean. Within the texts of the three authors mentioned here the term "Hindu science" is an empty signifier, and this is clarified in Sarkar's *Hindu Sociology* as much as in the *HAES* as is evident from passages subsequently cited.

But the challenge concerning the exact and the positive arises from the claim "that the age of experimental and inductive science is about three hundred years. It is this period that has established the cultural superiority of the Occident over the Orient. But this epoch of 'superiority' need be analyzed a little more closely" (Sarkar 1918, 6). The term "Hindu" is employed merely as

4 As we shall see ahead, Seal, in explicitly setting out his hermeneutic, cautions against this approach.

a label marking the Sanskrit textual tradition's claim to a place in the pantheon of scientific nations, and not to connote any exceptionalism. This reversed the trope of India as a spiritual civilization, incorporating it into the comity of material and positive cultures. This also reveals the importance science had acquired as a marker of difference—as discussed in *Machines as the Measure of Man* (Adas 1990)—and the impact of Whewell's *History of the Inductive Sciences* (Whewell 1847) in prescribing a philosophical conception of science that was not just European.[5]

For Sarkar it was important to go beyond the Whewellian template that he elaborates so effectively with historical material and his patented brand of sociology. This interpretation could as well have been inspired as a form of what Eric Hobsbawm would have called cultural combat. Sarkar, as discussed in some earlier work (Raina and Habib 2004), was part of an important cultural movement inaugurated by Satish Chandra Mukherjee who went on to found the National Council of Education in the last decades of the nineteenth century. Sarkar departed from Rabindranath Tagore, Sri Aurobindo, and others who had been emphasizing the spiritual distinctiveness of Indian culture. Sarkar and with him several members of the breakaway Society for the Promotion of Technical Education argued for the materialistic and positive orientation of Indian culture, which would in turn strengthen India's claim to self-rule (Chatterjee 2014, 108, and Raina and Habib 2004).

In this attempt to re-envision the social sciences Sarkar identified several points of departure from standard conceptions of sociology and science. The sociological study was based on an analysis of Sukracharyya's *Sukraniti*. Turning to an ancient Indian text to ground a new sociology was in turn a product of India's attempt to stake its claim to modernity, which Sarkar had earlier set out to construct a history of the natural sciences of India. Sociology for Sarkar provided the conceptual/theoretical instruments not only to understand Indian society but also to destabilize the representations of India that were developed by Orientalists and Indologists—if one may say this *avant les lettres*. In a way then, this claim to and assertion of modernity reflected the preoccupation with India's "present rather than her past" (Chatterji 2007, 130). But the classical Indian work that Sarkar took up in the project of reconstructing

5 Sarkar reminds us that Whewell admitted that the Hindus "felt the importunate curiosity with regard to the definite application of the idea of cause and effect to visible phenomena," "drew a strong line between a fabulous legend and a reason rendered," and "attempted to ascend to a natural cause by classing together phenomena of the same kind." Sarkar is surprised that this "attitude of mind" Whewell does not find "in any non-Greek except the Hindu! He forgets altogether the claims of the Chinese." The surprise is explainable in terms of his predisposition to the idea of science as a cultural universal (Sarkar 1918, 75).

the social sciences was devoted to identifying the landmarks in India's cultural history and did not examine the dynamic processes of the growth of civilizations (Sarkar 1921, 1). Nevertheless, Sarkar's study was based on his engagement with the non-mystical elements of Indian society, or the positive elements of "Hindu social economy" (Sarkar 1921, 5). Consequently, the study of Indian civilization commenced with a re-examination of the methods hitherto adopted, their shortcomings, and their relevance.

It has been pointed out that the responses of the Bengali Bhadralok class to theories of biological and social evolution were quite different. Theories of biological evolution were easily assimilated within the Hindu cosmologies. However, theories of social evolution, clothed as Social Darwinism, were opposed and resisted within the circle being discussed (Raina and Habib 1996). In fact, there appears to have been a larger disagreement with theories of social evolution as opposed to biological evolution. The distinct stance of the circle to which Sarkar belonged, its signature so to speak, is evident in the introductory remarks of the book. Sarkar disengages his work from theories postulating progressive stages of social development. His concern was not to identify the "several stages in the making of modern Indian life and thought" (Sarkar 1921, 1). This also meant the rejection of the standard chronology of societal evolution. Nevertheless, several broad points of departure may be identified and these are balanced by several methodological and conceptual clarifications, one of which deals again with the notion of the positive.

The first of the rejections addresses the portrayal of Indian civilization as transcendental or religious. Sarkar argues that the

> transcendental and other-worldly aspects of Hindu life and thought have been made too much of. It has been supposed and believed during the last century that Hindu civilization was essentially non-economic and that its sole feature was ultra-asceticism and over-religiosity such as delight in condemning the "World, the Flesh and the Devil."

Sarkar opposed this characterization for he felt that "Nothing can be farther from the truth" (Sarkar 1921, 6). On the contrary, he proposes that "Human life is never governed by religion which is everywhere a brilliant superstition consisting in the vain effort to understand the nature of God" (Sarkar 1921, preface, 15). The study of the history of India in his view ought to commence with the recognition that the transcendental, the religious, and the metaphysical reveal themselves through the positive, secular, and metaphysical (Sarkar 1921, 6). In other words, the culture synthesized the polar dichotomies of

Western culture, namely worldly/otherworldly, positive and transcendental, culture/faith, science/religion (Sarkar 1921, 6). He appeared to be pushing social science theory beyond its standard dichotomies. But to what end?

Evidently the perceived inadequacy with this characterization of Indian culture is echoed in his unhappiness with Weberian sociology, which runs through the introductory chapter. A passage he finds particularly objectionable, because it does not reflect for him the social reality of Indian life, runs as follows: "The Hindu spirit is very religious and very speculative. Obstinate guardian of traditions, it is singularly insensible to the joys of action and to demands of material progress" (Weber, quoted in Sarkar 1921, 18). This he indicates is the "most representative and substantial interpretation of the modern Eur-American (*sic*) world on Indian culture as developed in and through Hinduism and Buddhism" (Sarkar 1921, 18). This representation of India was widespread in the so-called social sciences, authorized naturally by Weber's sociological investigations. This dissatisfaction with Weber's construction of Hindu society would resonate amongst subsequent generations of Indian academics. But this theory of Indian society had been taken up by a number of Asian thinkers who adopted the "fallacious sociological methods" of the modern West. The method was premised on the distinction between "the Orient and the Occident" as the first principle of science (Sarkar 1921, 19).

The second departure presents itself in the interrogation of the representation of India by Indologists. Indology did not begin with Max Mueller but his *Sacred Books of the East* series were certainly raised to the level of the canon with regard to Indian civilization and culture. Sarkar would argue that the *Sacred Books of the East* series, alongside *India: What it Can Teach Us*, and *Chips from a German Workshop*, had merely presented the idealistic, the metaphysical, or mystical side of Indian culture to the exclusion of its materialistic, secular, and objective side. And it was this side that Sarkar was interested in revealing (Sarkar 1921, preface, 9). The lopsided emphasis had in fact played up the distinction between Orient and Occident. Thus arose the strident rejection of the notion of Oriental or Occidental ideals of existence (Sarkar 1921, preface, 14). He would write: "It is the subordination of the East to the West in recent times both in politics and culture that has inspired the bombastic jingo fallacy: 'East is East, and West is West' " (Sarkar 1921, preface, 16).

If Weber's sociology was problematic, Max Mueller's *History of Sanskrit Literature* (1860) created the image of India as marked by vague idealism, unpractical mysticism, and otherworldly absurdities. Methodologically this image was a product of three fallacies. The first of these was attributable to the ignorance of the positive, materialistic, secular institutions, and theories of

the Hindus. The second arose from a comparative reading of history marked by a deep chronological asymmetry. Features of ancient and medieval India were frequently compared with the features of the modern "Eur-American" world. This historiography portrayed the West as enlightened and progressive, while India was arrested in tradition and scholastic medievalism. And finally, the most important objection that was even more difficult to dismiss was the inability to differentiate or appreciate the distinction between institutions and ideals (Sarkar 1921, 21). Reversing these methodological fallacies would become Sarkar's *cause célèbre*.

But what of the notion of the positive? In the first instance the term could have been taken to connote the experimental realm of knowledge. But we need to understand the meanings and sources of the actors. Did they have a different proposal? What did Sarkar mean by the term "positive"? To evince this we have to go back to Auguste Comte's ideas of the functional evolution of mankind characterized by three mental stages; and the last of the stages, the *état positif*, marked by the reign of experience (Sarkar 1921, 11). This appreciation of Comte's social evolution is schematized below.

Stages of Development	**Theological**	**Metaphysical**	**Positive**
Nature of the stage of development	Fetishism, polytheism, monotheism	Scholasticism	Age of speciality and generality
Dominant social groups	Warriors	Legists, juriconsultants	Scholars
Dominant forms	Reign of imagination	Reason	Experience

Sarkar proceeds to depart from this picture, for the only connection he sees between *The Positive Background of Hindu Sociology* and Comte's *Philosophie Positive* lies in the value he attaches to the category "positive." Positive knowledge is construed as an assemblage or association of scholarly activity, exact knowledge, based on experience or experiment, followed by generalization, specialization, where science appears as the antithesis of religion (Sarkar 1921, 11). In other words, the idea of the positive ensconces the notion of an intellectual reform that precedes the reform of society.

Thus, while concurring with the notion of the positive, Sarkar objects to the law of three stages. These objections arise from his understanding of Indian

society and are equally inspired by Western critiques of Comte. Sarkar rejects Comte's law of the three stages, as "an objective exhibition of the dynamics of culture-history." The theory is rejected on the grounds that historically it would be impossible to identify an epoch where reason ruled supreme to the exclusion of imagination or experience, or even where the writ of imagination prevailed to the exclusion of experience or reason, or even further experience prevailed to the exclusion of imagination and reason. In other words the idea of sequential development and progress was not found acceptable. It was argued that there were no anthropological or psychological grounds to infer that imagination belonged to the primitive mind, and that this stage was a precursor to that where ratiocination and concrete experience dominated (Sarkar 1921, 11). This critique of Comte's law was shared with a number of Western scholars and he acknowledges the influence of Leon Brunschvig, René Worms, and Lucien Lévy-Bruhl (Sarkar 1921, 12). Sarkar was in the process of rejecting the characterization of Indian civilization as anchored in a stage where the spiritual and metaphysical predominated. Neither at the cognitive level nor at the societal level was Sarkar ready to retain in his social theoretic scheme the idea of progress as accepted by his western contemporaries.

How exactly did Sarkar envisage changing this picture of India and highlighting its positive side? This was to be accomplished programmatically by altering the focus of priorities of research on the history of Indian art, a study of its economy, and political systems over the centuries. Furthermore, literary criticism was to create, interpret, and study the canons of Hindustan's literatures, which included the Sanskritic, Dravidian, and vernacular (Sarkar 1921, 12).

This would tell us far more about "the marriage rules, the joint family, the cottage industry, the autonomous system of cooperative village communities… the elastic theological apparatus and religious paraphernalia, the institution of kingship … that constitute the complex of Indian life" (Sarkar 1921, 13) and was to comprise the basis for the sociology of the region.

This brings me to the last point about Sarkar that I wish to emphasize in this essay, namely his symmetrical approach to the study of modernity in both the East and West. He argued that the new technological discoveries, such as those in the steam-and-machine-age were surely revolutionary for Asians as much as they were for the "Eur-American" world (Sarkar 1921, preface, 16). Consequently, these developments were not to be taken as signs of peculiarly

Occidental or non-Oriental exceptionalism.[6] On the other hand, since the site of some of these discoveries was Europe, and these revolutionary changes emanated from there, it could not be argued that they were either unsuited to the Oriental genius, or antagonistic to the spirit of the Orient, even though they may be considered emblematic of materialist civilization. On the contrary while these developments were modern, this revolutionary age should be seen as constituting "one of the phases of the world's evolution." These developments could be assimilated by any system of human polity depending on "the stage and requirements of its growth" (Sarkar 1921, preface, 17).

And yet in denying European exceptionalism, he was also denying Indian exceptionalism. The symmetry underlying this approach reinforced his attempts at constructing a more robust social theory. Thus he was to write: "So-called Hindu ideals there are none; there is nothing exclusively Indian in Hindu culture; any idea, fact or truth alleged to be the essential characteristic of the 'spirit of Hinduism' is at the same time the feature of the genius of other lands … India is not one, but many" (Sarkar 1921, preface, 18). We see therefore in Sarkar's oeuvre a meeting ground of Western critiques of positivist social theory and Indian resistance to constructions in the terms of this very social theory.

It must be mentioned nevertheless that Sarkar called his method historico-comparative. Apparently, he did not envisage a complete break with Western social science theory or history; and he felt that a proper appreciation of the achievements of the sciences of India could only be acquired against the backdrop of the landmarks in the history of Western science. The application

6 Rejecting the idea that the scientific revolution was the moment of great divergence between East and West, Sarkar suggests instead: "The real and only cause of the parting of ways between the East and the West, nay, between the mediaeval and the modem, was the discovery of steam, or rather its application to production and transportation. The steam engine effected an industrial revolution during the first three decades of the nineteenth century. It is this revolution which has ushered in the 'modernism' of the modem world in social institutions, science, and philosophy, as well as brought about the supremacy of Eur-America over Asia. The year 1815 may be conveniently taken to be the year one of this modernism, as with the fall of Napoleon it marks also the beginning of a new era in world-politics, practically the era in which we still live. The difference between the Hindu and the Eur-American, or between the East and the West, is a real difference to-day. But it is not a difference in mentality or 'ideals' or so-called race genius. It is a difference of one century, the 'wonderful century,' in a more comprehensive sense than Wallace gives to it" (Sarkar 1918, 7). Writing half a century later, the physicist and historian of science, John D. Bernal, identified the eighteenth and nineteenth centuries as "the great formative centuries of the modern world … representing a liberating phase of human development in which man had at last found prosperity and unlimited progress…. The new methods of experimental science elaborated in the seventeenth century were to be extended over the whole range of human experience and at the same time in their applications were to keep pace with and infuse the great transformation of the means of production we call the Industrial Revolution" (Bernal 1965, 504).

of this method would for him reveal that the idea that the Indian mind was predisposed naturally to metaphysical and unpractical speculation was founded on what he terms "mal-observation and non-observation" (Sarkar 1921, 4). This image was produced by the ignorance of the positive background as reflected in its socio-economic and socio-political life. The picture of metaphysicians, philosophers, and transcendental speculators is then a distorted one (Sarkar 1921, 5). It is curious that Sarkar's radical critique would not echo in the social sciences in India or abroad or in educational curricula in subsequent decades. When a homologous critique crystallized in the 1960s and 1970s, its genealogy would commence elsewhere.

The question of method

Brajendra Nath Seal was a philosopher who wrote an epistemological monograph on the sciences of India entitled *The Positive Sciences of the Hindus* (hereafter *TPSH*) in English. The early chapters of the book explore the so-called mechanical, physical, and chemical theories of the "ancient Hindus." For more than one reason it is important to read Seal's and Sarkar's books together. Both scholars belonged to the same social network of Bengali intelligentsia, were very closely associated with the National Council of Education, and wrote in the same newspapers, reviews, and periodicals (Sarkar 1946). In order to develop a new curriculum for the colleges and universities they came to be associated with, an attempt to restore, refurbish, and revitalize the past was required. Beyond being active members in similar associations and societies, Seal's book was published before Sarkar's and the latter cites the former in sufficient detail to develop his argument. But Sarkar's agenda went beyond exploring the methods of the natural sciences. He aspired to set out the method and scope of the social sciences as well, even though one of the works discussed here deals with the exact sciences. Seal's book possibly had a more lasting reception than did Sarkar's. This is because it became one of the canonical texts on the history of science and scientific method of the period. More importantly two chapters of the book conferred on it an extended shelf life. These chapters were republished in the second volume of one of the most important histories of science produced by an Indian chemist, viz. the *History of Hindu Chemistry* by Ray (Ray 1902; Raina 2014). The chapter on the scientific method, which in fact was the seventh chapter in Seal's book, was canonized as an authoritative statement on the methodology of sciences of India.

In Ray's volume, Seal's chapter on the mechanical, physical, and chemical theories has a preface where Seal lays out his methods and concepts. The chapter of *TPSH* on mechanical and chemical theories, Seal points out in his

preface to the Ray volume, offered a synoptic view "of the entire field of Physico-chemical science," covering those elements that "reached the stage of positive science as distinguished from the mythological and empirical stages" (Seal, in Ray 1909, E). In other words, features of so-called positive science coexisted with the other stages in the growth of knowledge. Chapter VII of the *TPSH* appears as an appendix in the second volume of Ray's history. Clarifying his motivation for writing the chapter Seal makes explicit his historical practice for interpreting the one system in the language of the other. He starts out in the *TPSH* by suggesting that the necessity for studying the methodology of the sciences of India derives from the need to arrive at "a right understanding of Hindu positive sciences," and as a philosopher attempts to take on board "its strength and its weakness, its range and limitations" (Seal 1915, 244). But the task he undertakes is a history of philosophical and scientific ideas.

The purpose of his enterprise is thus to show that this science was not "all practical recipe" and "unverified speculation," and that the movement was "positively scientific." But for this generation of Indians, it was still too early to break out of the Orientalists' tropes, and Seal employs the trope of the decline of the sciences of India, whose growth he suggests was "arrested at an early stage" (Seal 1915, 244). In the preface to Ray's book again he clarifies that his purpose is to expose the methodological precepts of this knowledge, that in fact it was not "unverified and unverifiable speculation (the very antipodes of science)" (Seal, in Ray 1909, F). Before establishing the scientificity of the methods employed, he sets about clarifying his own method of engaging with the sources. The first step he refers to as returning to the original Sanskrit sources and eschewing any secondary literature. The second is his attempt to overcome historical presentism, as he writes that he seeks to guard himself against "the unscientific, unhistorical but very common and almost inevitable habit of reading modern ideas into old guesses or speculations of a happy-go-lucky or nebulous character." In other words he finds the need to protect himself against this "fatal facility of unconscious distortion or misrepresentation" (Seal, in Ray 1909, G). Like Sarkar he too sees himself as a practitioner of the historico-comparative method that he first employed in his comparative study of Vaishnavism and Christianity published in 1899.

Inductivism as a philosophy of science developed by Mill and Whewell had a positive reception amongst these Indian interlocutors. The Indian encounter with Western inductivism goes back at least half a century before Seal's book was published. In 1852, James Robert Ballantyne, the superintendent of the Benaras College between 1846–1861, published a work entitled *Synopsis of Science from the Standpoint of Nyāya Philosophy* (Ballantyne 1852), and as is evident from the title, the objective was ostensibly to compare Western and

Eastern philosophy from the point of view of the methodology of obtaining knowledge.[7] The contents included a discussion on Western logic, science, and history. It was written with the goal of dispersing European ideas among Sanskrit pundits at the college, such as Bāpudeva Sāstri and Vitthala Sāstri (Dodson 2010, 102–103), and deriving its engagement and style from the Nyāya-sutras (Ganeri 1996, 11). The work devoted specific importance to the processes of inference and induction for, as Ballantyne pointed out, it was the Baconian conception of induction that underpinned the progress of the sciences, and rather than refute the Hindu speculations on the subject, the hermeneutic of the conversation was to "take as a starting point some established point in their own philosophy, and to show how the philosophers of Europe have followed up the enquiry" (Ballantyne 1852, xi). And what better text was there to stage this conversation than Francis Bacon's *Novum Organum*, although it was a work considered *passé* in Europe at the time. Until the beginning of the nineteenth century it was considered to be the seminal text in Western philosophy engaging with a rational scientific methodology. The application of this method would, it was argued, lead to the discovery of new and useful "truth"/ knowledge that could in turn improve mankind's material conditions. As Michael Dodson writes, the *Novum Organum* "was thereby characterised as the text which best represented Europe's transition into modernity through the presentation of an enabling scientific methodology" (Dodson 2010, 106).

As pointed out earlier, Seal, unlike Sarkar, engages with Mill's *A System of Logic* (Mill [1843] 1973–74) in order to translate the methodological premises of science in India. His reading of Mill has to be reckoned with at three levels. Firstly, *A System of Logic* has to be read as a philosophical exposition of the scientific method. Secondly, it offers Seal a model to be adopted in order to demonstrate the scientificity of the methods of the so-called Hindu sciences. Thirdly, Seal appeared to have been producing a response to what he perceives to be the limitation in Mill's *A System of Logic*. In the last chapter of *TPSH* of about fifty pages, laying out the methodology of the sciences of India, Mill's work figures eight times. In addition to logic, Mill discussed the methods of science in studying natural and social phenomena. Thus while the book was titled *A System of Logic* one should not be deluded into thinking

7 To H. T. Colebrooke must go the credit for canonizing the mathematical and logical traditions of India for nineteenth century Indologists. If his translations from Brahmagupta's and Bhaskara's work played a role in stimulating European interest in Indian algebra, the discovery of the Hindu syllogism through his engagement with Gautama's Nyāya-sutra (Colebrooke 1824) became the standard reference on Indian logic through the nineteenth century, generating in the process great interest and influence amongst mathematicians at the Royal Society and attracting the interest of researchers and Indologists at the Royal Asiatic Society (Ganeri 1996, 4).

that it was a work on formal logic. On the contrary, Mill's proposal of the "logic of consistency," dealt with the procedure of deriving conclusions from evidence, based on an analysis of causation and inductive reasoning. The principles of experimental sciences were discussed in Book III of *A System of Logic*. It could be argued that Mill's work serves Seal as a Kuhnian exemplar for the exposition of the methodology of the sciences of India, as much as it is a work in comparative epistemology.

Interestingly, Seal's book, while written in English, is generously punctuated with quotations from the relevant Sanskrit texts and has four indices at the end of the book—a large number given that the book comprised 295 pages exclusive of the index. The first index is in Sanskrit and lists the Sanskrit authorities cited, the second is also in Sanskrit and indexes the Sanskrit texts cited, the third is again in Sanskrit, indexing the philosophical terms employed in Sanskrit, and this is followed by an index in English, not as detailed as the previous two. Furthermore, if to scrutinize the section headings of Chapter VII and X of Mill's book and Chapter VII of Seal's book (see the table below), a pattern becomes evident. The pattern reveals that the epistemic organization of the chapters of Mill's book provides Seal with a structural template to discursively expose the methodology of the sciences in India. And as a work in comparative epistemology it uncovers the similarities and differences in terms, concepts, and methods. While pointing out the limitations in the Indian procedures, it also points out that the Indian procedures in places are "more comprehensive as well as more original and suggestive than Mill" (Seal, in Ray 1909, F). The approach consisted of revealing the inductive method by proceeding not necessarily in the sequential order of the chapterization of *A System of Logic* but in a reconstruction that keeps the structure of the epistemic elements between the two thought systems in conversation and builds a parallel methodological framework, not identical, but similar to that of modern science. In order to do so, the method employed is "historico-comparative." And here too he proposes a hermeneutics of caution: "I have also practiced, or tried to practice, a habitual understatement, without unconsciously falling into that 'suppressio veri' which is so often a 'suggestio falsi' " (Seal, in Ray 1909, G). The table below illustrates Seal's historical comparative method at work—that of ferreting out cognitive homologues from the different Indian philosophical schools or *darśhanas*.

Chapterization of J. S. Mill's *A System of Logic*	**The Subsections of Chapter VII of B.N. Seal's** *The Positive Sciences*
Book II, Chapter VII: On Observation and Experiment	Observation and Experiment; Results in the Different Sciences
Book V Chapter IV: Fallacies of Observation	Fallacies of Observation
Book II, Chapter I: Of Inference	Doctrine of Inference, Analysis and Indication of Inference; How to Ascertain Concomitance
Book III, Chapter VI: Composition of Causes	Specific Cause and Effect; Canon of the Method of Subtraction
Book III, Chapter VIII: Of the Four Methods of Experimental Inquiry. [Method of Agreement; Method of Difference; the relationship between the previous two; Joint Method of Agreement and Difference; Method of Residues; Method of Concomitant Variations] [Mill, 1973, 388–406]	The Joint Method of Difference, Proof of the Method…; Unconditional Antecedent…; Elimination of the Irrelevant Factors; Nyāya Objection to the Method of Difference…; Synchronousness of Cause and Effect
Book III, Chapter X: The Plurality of Causes, and of the Intermixture of Effects	Plurality of Causes, Nyāya Ground of Inference; Vyāpti/unconditional Concomitance…; Difference between Nyāya Method and Mill's Joint Method of Agreement…
Book III, Chapter XI: The Deductive Method	The Deduction Method…; Navya Nyāya and its Significance in the History of Thought…; Applied Logic
Book VI: On the Logic of the Moral Sciences	The Logic of Particular Sciences
Book VI, Chap VII: … Experimental Method in the Social Sciences	The Scientific Methods as Applied to Therapeutics
Book VI, Chap X: The Inverse Deductive or Historical Method	The Scientific Method as Applied to Grammar and Philology

Thus Seal suggests that the Indian physico-chemical theories and classifications commenced with the observation of instances that were analyzed and sifted. This procedure was meticulously followed in the texts on *materia medica* and meteorology (Seal 1915, 243–247). Lest it be construed that this was

the character of all the sciences, Seal is quick to point out that as far as observational astronomy was concerned, the quality of the observations was to say the least, lacking. However, he had to explain the agreement between the calculation of the lunar constants entering into the calculation of lunar periods and eclipses with the figures in Pierre-Simon Laplace's tables. This was accomplished by "a systematic process of verification and correction by comparison of the computed with the observed results" over more than a thousand years (Seal 1915, 247). Does the overall structure fit into an inductive framework? Seal was very cautious about making this claim for he points out that the experiment "as an independent method of proof or discovery" was rarely recorded in books though they were not entirely absent. Having said that, he does point out the rare instances where experiments are referred to in works such as Udyana's *Kiraṇāvalī* (Seal 1915, 248). Ray would in his own work cite several other such instances from Indian alchemy (Ray 1902).

There are several aspects of Seal's work that merit a detailed discussion, but the point I wish to emphasize here is that Seal takes up Mill's work as a template to frame his own exposition of the Indian tradition. It was in Book III, Chapter VIII of *A System of Logic* that Mill discussed the four methods of experimental inquiry, where experimental reasoning was employed to connect a condition preceding or accompanying a phenomenon with an invariable law. Of these four methods, those of agreement and difference are clearly the most important and draw Seal's attention for he reckons with some similarity between Mill's and the Indian conception of science, in as much as the latter was also inductive and ratiocinative. Thus the Indian doctrine of inference or *anumāna* is "based on the establishment of an invariable concomitance between the mark and the character inferred."[8] In other words this system of inference was "neither merely formal nor merely material." In that sense it differs from Mill's, since it combined the formal-material and deductive-inductive processes; in other words the method was neither identical with the Aristotelian syllogism (formal-deductive) nor with Mill's induction (material-inductive process). This inference combined formal validity with material truth (Seal 1915, 251). The procedure for making an inference is then discussed in detail. But Seal's exposition concludes that *anumāna* or analogy in the Indian tradition anticipates Mill's analysis of the syllogism as a material inference, "but is more comprehensive." In the five propositions of the Indian syllogism, the third one, called *udhārana*, "combines … Mill's view of the major premise" of an instance already observed, "fortified by a recommendation to extend its application to unobserved cases." In the Aristotelian view this is

8 Ballantyne's treatment of the method of induction correlated closely with the Nyāya discussion of apprehending invariable concomitance, and this itself was recognized as the common ground of the two traditions (Dodson 2010, 106).

the formal ground of inference. However, there is the requirement of *vyāpti*, invariable concomitance, between the mark and the character inferred, which is the ground for an inductive generalization. The problem of induction for Mill and Seal is, therefore, to resolve the following: "under what conditions are we justified to assert a Universal real proposition on the basis of our necessarily limited observation" (Seal 1915, 252). We come back to this in the next paragraph. Seal completes his elaboration by pointing out that applied logic, or the "logic of the special sciences," is a characteristic feature of Hindu scientific investigation (Seal 1915, 290).

Coming back to the question of the methods of agreement and difference, Seal sees in the Nyāya textual tradition both similarities with Mill's methods and the possibility of surpassing the limitations inherent in Mill's formulation, and suggests a qualification to the method of difference in its negative aspect, that he labels the "method of subtraction"[9] (Seal 1915, 257). However, the method is still not free of difficulty, for there are two different aspects to the definition of a cause: "(1) the unconditional invariableness of antecedence, (2) the immediateness of antecedence" (Ibid., 258). The proposed revision of Mill's method of difference required its enunciation in a form that emphasized the forgoing aspects. Drawing on a method encountered in later Buddhist works called the *Panchakārani*, Seal labels this revised method the "method of joint difference" (referred to in the table above), which combines the positive and the just footnoted negative forms (Seal 1915, 258). The five distinct steps characterizing the joint method of difference according to the *Panchakārani* are discussed in the work, but are basically directed towards foregrounding the unconditionality and immediateness of the antecedent. This is recognized by Seal as the source of revision of Mill's canon, in addition to being consonant with experimental practice. The stronger claim Seal makes, which I do not attempt to engage with here since it is not relevant to the paper, is that an exploration and analysis of *anumāna* in the Nyāya tradition would disclose a more comprehensive account of the syllogism than does Aristotle's or Mill's analysis (Seal 1915, 259). What is characteristic of "the Hindu scientific mind" for Seal is that "without being content with the general concepts of Science and a general Methodology, it elaborated the fundamental categories and concepts of such of the special sciences as it cultivated with assiduity, and systematically adapted the general principles of Scientific Method to the requirements of the subject-matter in each case." And the most notable

9 In the text Seal elaborates: "Now, if A disappearing B disappears, even though all other antecedents remain and there is no other change in the case, then and only then can the causal relation be ascertained. It is not a mere table of positive or negative instances…; it is this Method, which we may term the Method of Subtraction…, that is the only exact and rigorous scientific Method" (Seal 1915, 257).

example for Seal is the logic of therapeutics of Charaka (Seal 1915, 291). This idea would later animate Ray's history of chemistry and the history of scientific philosophy of Debiprasad Chattopadhyaya (Chattopadhyaya 1979) where they sought to elaborate the idea of methodological robustness of ancient Indian medicine.

From the positive to the exact

The vocation of the "exact" and "positive"—two terms employed to characterize the so-called sciences of Indian antiquity—need to be contextualized within the larger history of the institutionalization of the natural and social sciences in late colonial Bengal. And yet both these terms are key concepts in the disputes over method that animated the philosophy of sciences from the end of the nineteenth century in the West. This concurrence is not accidental; Sarkar and Seal employed a procedure called comparative history to explore and possibly revitalize the Indian tradition. I suspect that *The Hindu Achievements in the Exact Sciences* and *The Positive Sciences of the Ancient Hindus* fall into this genre of comparative exploration. An earlier study had used the term "critical assimilation" to refer to one response of cultural redefinition of modern scientific knowledge in late nineteenth century India (Raina and Habib 1996). Though the response was so characterized more than a decade ago the term still does some justice to the project of these two philosophers.

The ideas of Mill and Whewell acquire a second level of salience. They were embroiled in a vitriolic debate in the nineteenth century that remains relevant to the history of philosophy of science, and reveals the social and political values that frequently underpin scientific debates. While both believed that the British public should support the anti-slavery movement in North America, both also believed that it was philosophy itself that needed to be revamped before the political and social system could be reformed; and that the transformation of society could be initiated through the elaboration and dissemination of a new philosophy of science. Again they disagreed about which one, for each of them believed that their own philosophy of science was best suited to the task (Snyder 2012, 11–13). This aspect of the Mill-Whewell debate possibly appealed to Seal and other members of the circle—the idea of the evocation of the scientific method prior to the social engineering of society. For Seal and Sarkar this could be done by reworking the resources of Indian philosophy and the positive sciences.

An important distinction has to be drawn between the response to Baconian inductivism in Banaras in the 1850s, and the response to the inductivism of Whewell and Mill in Calcutta at the end of the nineteenth century. Ballantyne's

Synopsis was motivated by a larger programme to diffuse European knowledge but was restrained hermeneutically by two considerations. The first, as a form of dialogue, sought a common philosophical anchor in European and Indian philosophy; the second strived to establish that Baconian inductivism surpassed the "Hindu syllogism" (Dodson 2010). In the turn-of-the-century histories of science authored by Ray, Seal, Sarkar, and others on "Indian" inductivism, the aim ostensibly was to establish that the sciences of India rested on robust methodological foundations, pivoted around the core *pramāṇa* of *anumāna* or inference.[10] Neither Seal nor Sarkar refer to the *Synopsis* but engage with and draw upon Whewell and Mill, suggesting that the discussion on Baconian inductivism was already *passé*. Seal particularly argued that the Indian syllogism far surpassed Mill's method.

There remain questions that need to be answered concerning these philosophical conversations across time and geographies. The philosopher Bimal K. Matilal rejected the objection that twentieth century attempts to articulate the ideas of the ancients were futile. On the contrary, while the motivations of philosophers from different periods and cultures differed there were important philosophical questions and puzzles that continued to be of contemporary relevance. These included "the problem of knowledge and its criteria, the problem of perception and the status of the external world" (Matilal 1986, 2–3). It stands to reason that the problem of what counts as valid knowledge has been addressed differently by philosophical systems such as those of the rationalists who foreground reason and the empiricists

10 David Zilberman's *Analogy in Indian and Western Thought* was published about eight decades after Seal's book, and could be seen as another attempt in comparative philosophy addressing the question of method in the two traditions. Curiously enough, Seal's book is not referred to here. Zilberman begins by pointing out that nothing new on the subject of analogy had been added to Western philosophy since Aristotle's *Prior Analytic*, despite the philosophical literature drawing widely upon "analogies, examples, paradigms and incomplete inductions." He sees Mill, as does Seal, as the one philosopher who extended the concept of analogy into the foundations of the logic of scientific discovery by developing the method of similarity and differences (Zilberman 2006, 45). Turning to the theory of analogy in Indian philosophy, the circumstances of its development are very different, but the theoretical positions of the different philosophical schools exhibit "a deep and well understood supplementariness" (Ibid., 46). This is the reason why the reader of Seal's *TPSH* encounters an elaboration of the Nyāya point of view constantly measured and clarified with respect to the position of the other schools. In the light of the multi-systemic character of Indian philosophy marked by their supplementary relationship, Zilberman proposes a three-stage model for periodizing successive theories of analogy (Ibid., 48–9). The spectrum of conceptions of analogy confers the organization of philosophical and scientific knowledge with an inter-systemic characteristic of complementariness. Zilberman sees the juxtaposition of the variants and solutions as a "family of paradigms for working out our contemporary problems in the sociology of knowledge, and in the logic and methodology of science" (Ibid., 50). The books of Seal and Zilberman are separated by more than eight decades, and yet there are two points on analogy in the Indian philosophical system about which they may have been in agreement.

who foreground science. (Mohanty 2001, 6). The concerns of philosophers writing in Sanskrit was pivoted around the question whether perception was the only means of acquiring valid knowledge (*pramāṇa*) or whether inference (*anumāna*) was also a *pramāṇa*. What needs to be reckoned with is that the epistemological vocabularies in the two traditions are comprised of terms considered synonymous, but actually denote different objects. One of the arguments cited by Jitendra N. Mohanty is that comparative philosophy is an unavoidable enterprise for cultural amphibians, forever rendering one tradition in terms of another or translating from one language into another. But then one must ask what philosophy is—is it about things in themselves or about the comparison of ideas, concepts, and theories? According to Mohanty comparative philosophy is a second order discipline serving the important role of liberating philosophers from dogmatically inhabiting their own traditions and thereby freeing philosophy itself (Mohanty 2001, 85). Mohanty identifies four ways in which the enterprise of comparative philosophy is undertaken. The first he calls intellectualist, and the engagement is initiated when a philosophical tradition A is perplexed by some problems that seek a solution and turns to philosophical tradition B in the hope of being enriched by it or being aided in finding a solution. The downside of this engagement is that votaries of tradition A may tend to view the tradition as possessing a solution to all problems (Mohanty 2001, 87–88). The second path is that of the wisdom seeker, and this path is characterized by an asymmetry. Indian philosophy is portrayed as mystical and a blind eye is turned to the analytical, logical or epistemological components or traditions in Indian philosophy. In like manner, Indian philosophers studying Western philosophy have paid little attention to the Christian mystics or the Gnostics (Mohanty 2001, 87–88). In this manner a particular construction of Indian philosophy is reproduced on both sides of the East-West philosophical divide. The third modality is that of supplementation and it could be seen as a variant of the first proposed by Mohanty. The programme of supplementation is prompted by the desire to fill up perceived gaps and vacancies in one tradition by importing the missing components from another tradition. The problem then is that this filling up may not be tantamount to assimilating the imported components into the deficit tradition—"it may remain external or an appendix to the tradition" (Mohanty 2001, 89). And finally, I suspect we have the purely philosophical modality, that Mohanty and Matilal are themselves committed to, which is the project of "recognizing how a different tradition realizes a quite different possibility not envisaged in one's own" (Mohanty 2001, 89).

It could be argued, following Mohanty on the hermeneutics of comparative philosophy, that Seal's intent was equally to reveal the possibilities of the Indian syllogism that were not anticipated in the European tradition and vice

versa. Despite this, Seal and Sarkar were agreed that the development of the scientific tradition in India was arrested at an early stage. The trend of the argument would suggest that if the scientific methodology rested on solid inductivist foundations then the causes for the arrest of the development of the sciences must be found elsewhere, rather than in essentialist explanations relating to dominance of speculative philosophies. From our own perspective, it is interesting to observe Seal employing Mill's *A System of Logic* as a model or scaffold for revealing the methodology of the sciences of India. We may marvel at Seal's scholarship and reading and yet find his identification of correspondences and cognitive homologies for "translating" Indian philosophy into a Western system highly problematic from a contemporary perspective. Similarly, Sarkar, as a perceptive critic of Comte's stadial theory of social evolution, would still consider the sociological project worthwhile enough to indicate what should be studied and how. While the term critical assimilation would functionally describe the process just mentioned, we have here a glimpse of how an image of a neutral and objective science had managed to lodge itself in the late nineteenth century Indian imaginary. This was only possible through efforts that worked across and within different cultural and philosophical traditions, searching out cognitive homologies to anchor the conversation.

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