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Postcolonial Narratives of Modern Science in the Making

The Exchange of Scientific Knowledge between India and Europe (1700–1950)¹

Dhruv Raina

This essay is concerned with theories of the transmission of scientific knowledge, and how postcolonial perspectives of science and the new sociology of scientific knowledge have altered the optic of transmission. The discussion maps different perspectives on the exchange or the circulation of scientific knowledge between India and Europe over the last three centuries. The overriding theoretical frame which anchors the standard tale of the history of scientific exchange between Europe and India has been that of modernization theory, wherein modern science is one of the constituents of modernity itself that encroaches upon and invades the domain of the traditional sciences of non-Western societies. Modern science is contrasted with the traditional sciences of India; a science whose growth was arrested for a number of social and cultural reasons (Chattopadhyaya 1979; 1982; 1986). Versions of the standard tale suggest that the rate of expansion of the dominion of modern science was curtailed by resistance posed by persisting pre-modern forces within these societies in transition. There are several cognate versions of this standard tale that share a number of tropes in common. As a history of transmissions it is pivoted on an osmotic metaphor (Shapin 1983) that conveys the idea that truth flows from regions of high truth concentration to regions of low truth concentration, from regions of light (read modern Europe) to regions of darkness (read the contemporaneous non-West).

Phase of Colonial Scholarship

Two principal stages in the evolution of the standard tale could be marked out, the first commencing in the second half of the eighteenth century and ending with the

¹ This is an abridged version of the paper presented at the 32nd Congress of the German Sociological Association, Munich 4th-8th October 2004. The original can be obtained from the author by e-mail.

end of colonial rule. The second stage follows in the wake of decolonization with antecedents in the last decades of the nineteenth century. The Orientalist phase, though quite nuanced, is one of the preliminary stages in the emergence of this discourse on the antiquity of the sciences in India. The landscape of the Orientalist historiography of the sciences of India is constantly changing from the end of the eighteenth to the middle of the nineteenth centuries (Raina 1999). In this early phase India was represented as the possible cradle of the sciences. And as Eurocentric theory began to consolidate its hold in the history of science towards the end of the eighteenth century, India was painted as a civilisation that had entered a state of decline from a phase of scientific creativity. The decline was so serious that much of the ancient wisdom was lost, and the core of that understanding was disfigured (Raina 2003).

This disfigurement provided legitimacy to the civilizing mission, and this is best exemplified in Mill's *History of British India*. Modern science was painted as Western and this scientific imperialism purported to civilize a decaying civilization. The transmission of modern science would illuminate regions of darkness and superstition. A class of Indians educated in modern science would draw upon elements of this theory of science to legitimate their scientific enterprise and to comprehend the causes of the decline of the sciences of India. These Orientalist and liberal indigenist enterprises shared an epistemic understanding of the universality of science. The distinction between the two resided in that the latter had embarked on divesting modern science of its purely Western identity (Raina/Habib 1996).

The Nationalist Phase

During the initial stages of decolonisation, scientists' in India also wrote history of science and sought to break out of the frame of Europe centred history of science (Bose/Subbarayappa/Sen 1970). Partially, inspired by the Needhamian historical project, they were asking for the causes of the non-emergence of a scientific revolution in India. But when investigating the more recent past, namely the colonial period, the primary concern was to understand the tardy expansion of the sciences in India over the last two centuries (Sen 1988; Rahman 1984). The impediments posed by colonialism in the path of authentic modernisation were historically investigated. Latent and explicit racism, colonial reservations concerning the abilities of Indians to pursue science or of competition from new sources were the causes imputed to the slow expansion of modern science during the period of colonial rule (Kumar 1995).

Investigations into the transfer of technology as of science envisioned the transfer of knowledge from the West to the East in terms of an arrow that pointed eastward. The West took from the East raw information that was cooked, processed, theorized upon and subsequently transferred to the East. George Basalla proposed the most evocative and debated of these theories in his work on the expansion of the European sciences (Basalla 1967). The theory itself was enveloped within a larger theory of modernization and a Rostowian understanding of the transfer of technology. The category called »colonial science« was invented to describe a particular stage in the institutionalization of science in the colonies. The science produced in this stage reflected the dependency of the developing world on the metropolises of science in the West.

Postcolonial theories of transmission

These frames underplayed the quality of science pursued in the colonies when contrasted with European or American science. Sociologists of science in the West were trying to frame this asymmetry in the production of knowledge in terms of a centre-periphery framework (David 1984). This geography of knowledge addressed the unequal exchange that marked the globalization of science. Scholars in India and abroad were predisposed at the time to looking upon the contemporary production of scientific knowledge, as well as the uptake of science during the period of colonial rule, as one of generating a derivative science. This derivative science was a lower kind of science, an appendage to the grand theories produced in the West.

However, in the 1980s and 1990s historians working on the transmission of scientific knowledge indicated that the centres of science were constantly shifting (Nakayama 1991). Further, a precondition for the evolution of scientific knowledge was innovation and transformation produced through the perpetual migration of knowledge from one region to the other (Pingree 1992). Consequently, it made little sense to speak of the derivative character of science pursued in the colonies or the former colonies. In the 1980s sociologists of scientific knowledge had independently suggested that the standard tale of the history of science were founded on a Western ideological assumption that knowledge germinated in the minds of exceptionally gifted individuals (Shapin 1994). This disclosure threw up a whole host of new actors that had been hitherto ignored by historians of science.

A couple of themes illustrating the departure from the standard tale are discussed below. Historians of science were now trying to chart out a departure from appendage history. There were those who attempted to obtain cognitive justice

within an ecumenical picture of science and those who were constructing an inverted image of the essentialist Eurocentric history of science. These trends were a product of changes in perspective in several areas of investigation.

Premised on a philosophy of science, that one could call neo-positivist, Goonatilake would proclaim the »rise of the East«. In his most recent work *Toward a Global Science*, Goonatilake employed a geological metaphor connoting colonial expropriation and directed it towards a different project (Goonatilake 1999). The intent was to set the record straight for the sciences and technology of the South Asian region by mining contemporary scholarship that is quite at variance with the dominant master narrative on how the West grew rich and, of course, powerful (Weber 1958; Rosenberg/Birdzell Jr. 1986). Other than the epistemic obstacles that have prevented the realisation of the emergence of a revised historiography, is the failure of scholars to account for the current diversity of the South Asian region, since almost every reconstruction commits the error of antiquarianism, and is afflicted by the romanticism of the Orientalists. Goonatilake insists that his enterprise is situated within the teleology of progress, and is sceptical of the fruitfulness of dubious parallelisms that are currently fashionable. He assumes a normative account of science that differentiates between empirical and pragmatic components of traditional knowledge and those that are patently spurious and unusable. Goonatilake sees the traditional sciences enriching modern science in two ways. (1) By directly splicing in material that has demonstrable validity – the hardware approach. (2) By introducing metaphors that dislocate standard ways of thinking, nudging the imagination into giving rise to new concepts. Goonatilake's radical thesis is to highlight the influence of South Asian ideas on the history of contemporary science and technology and not just modern science.

A perspective that breaks out of a neo-positivist philosophy of science and looks at the past of science from a different theory of history and theory of science came from the first generation of Indian cultural theorists (Uberoi 1978, 1984; Nandy 1980). The field was self-limiting two decades ago, though a glasnost had commenced, as the disenchantment with a particular frame of modernisation and development had set in since the mid 1960s (see chapter 2 in Raina 2003a). This disenchantment seeded an interrogation of European modernity and its conjugate modern science as solely paradigmatic of modernity and science. This was accomplished from two vantage points among others. The common understanding shared by both was that the dualism of fact and value logically culminated in a vivisectionist science, the concentration camps of Auschwitz and the nuclear destruction of Hiroshima. This modernity took its toll in genocidal development that the third world had been witness too (Uberoi 1984).

The first of the responses drew inspiration from Gandhi and generated a different vision of politics and of providing the template of an alternate modernity. In the

realm of the sciences, this inspired the search for alternate sciences and the possible episteme that underpins them within the scientific culture of modern India. This search recognised that the search for an Indian alternative would be »impossibly unmanageable« (Nandy 1980: 15). The other response that certainly viewed the Gandhian corpus in the same light turned its gaze upon Europe, and explored other European imaginations and non-dualist modernities.

The interrogation of modernity and the civilisational critique of modernity and science resulted in a re-examination of the encounter between modern western science and the so-called traditional sciences. The purport was to re-open the question of science and modernity that would disclose the form of other sciences and modernities, that were not as malevolent in their impact on the non-West. Ashis Nandy thus put two of India's first generation modern scientists, J.C. Bose and Ramanujan on the psychoanalytical couch to uncover the cultural specificity of their scientific projects (Nandy 1980). He commenced his investigation by rejecting the dichotomy that separated the content and context of science, since it exonerated the scientist of all criticism of the dystopian potentiality manifest within science. The study of Bose and Ramanujan sought to impress upon the reader how traditional cognitive orders creatively enriched the practice of contemporary science. A readership disenchanted by modern science saw this endeavour as opening a window into the world of alternate sciences. While Nandy was acute in his observations of the connection between the metaphysical and the psychological he left out the influence of the latter on the cognitive content of the science.

This necessitated the articulation of the historical, cognitive and institutional dimensions of science in order to decode the complex social processes involved in the institutionalisation and introduction of Western/modern science in India. The new foci of investigation were on the intimate relationship of scientific and technological projects to 19th century British imperialism; the impact of colonial rule on indigenous scientific knowledge and institutions; and finally the role of British and Indian scientists in the creation of scientific knowledge and the institutions of science. Furthermore these studies do not consider a romantic indigenous science as the epistemic mirror image of Western science, endowed with a sacred ethic that restrained it from going haywire.

In his book *The Science of Empire* Baber explored the symbiotic relationship between the expansion of colonial power and the production of scientific knowledge. The institutionalisation of modern science in India was a much more complex process, involving a complex dialectic of structure and agency (Baber 1996). An important point that Baber teases out is the immanent connection between instruction on science and technology in India and the emergence of the colonial capitalist state. This required that the colonial state be innovative in the founding of formal technical institutions. Drawing upon the work of Dionne and Macleod it is sug-

gested that these colleges served as models for replication in England in the late nineteenth century and the colonial encounter contributed to the development of technical education in England. (Macleod/Dionne 1979)

Speaking of a historiographic revolution in the last decades of the twentieth century, Sandra Harding recently pointed out that postcolonial science studies had affected three important changes. For one, it had helped chart out fresh perspectives on the integrity of the European sciences. Secondly, it had clarified the nature of the relationship between European and non-European cultures, thereby offering a different perspective on how modern science itself was reconstituted as a result of the encounter with the knowledge forms of the non-West (Harding 1998; Storey 1996). The researches undertaken by David DeVorkin, Richard Grove, S. Irfan Habib, Kapil Raj, Dhruv Raina, and more recently Gyan Prakash have argued that the standard tale of the assimilation of modern science as a Western cultural import is inadequate and misses out the multifarious nature of exchange between modern science and so called traditional knowledge forms (DeVorkin 1989, 1994; Grove 1995; Prakash 1999). Consequently, the expansion of European sciences was catalysed by the joint efforts of imperial bureaucrats, their scientific entourage and indigenous traditions. Indigenous elites visualised this encounter with science as a path to revitalisation (Raina/Habib 1993; Pannikar 1992; Raj 2000). This process could from a certain distance be visualised as a functioning trading zone where so-called indigenous knowledge forms transacted with the practices of modern science, though frequently in the idiom of modern science. This dynamic relationship itself constantly reshaped modern science.

The assimilation of modern science naturally commences at the level of pedagogy. The standard tale informs us of the replacement of the traditional pedagogy and curricula by the new ones under the pressure of the imperial dispensation. In reality, science teachers had to contend with local cultural conceptions and knowledge forms, as well as the need to mobilise existing teachers within modern schools. These contingent pressures opened up the gateways for a dialogue between modern science and the existing knowledge systems, a dialogue that generated interesting experiments in pedagogy and in science.

Similarly, the sciences that were undergoing theoretical consolidation from the seventeenth century onwards (Gascoigne 1996), were not merely enriched in terms of data pouring in from Latin America, Africa, South and South East Asia, China and the Far East (Blaut 1993; Storey 1996). On the contrary there was a constant interaction between the systems of classification of »natural objects« within these cultures as well as those that were evolving into the modern scientific system. Thus van Rhede's *Hortus Malabaricus* elaborates upon the botany of the Ezhavas of the Malabar coast, and Grove suggests the influence of this classificatory system on that developed by Linnaeus (Grove 1995). In like manner, surveying techniques as well

as map making practices were informed by the cultural practices of the regions explored by European adventurers in India and other regions of the world. These practices were subsequently integrated within modern science and the cultural signature of the regions from where they originated was retrospectively rendered invisible.

But how was the process of data gathering in science visualised within the division of labour of science. The activity of data gathering and calculation came to be considered a lower order activity in the Western European scientific imagination since the end of the eighteenth century (Daston 1994). Much of the science pursued in the colonies was of an empirical nature; the task of theoretical synthesis was to be performed at the metropolises of London, Paris, Berlin etc (Pyenson 1985; 1993). The science pursued in Calcutta, Auckland, Beijing or Tokyo in the early twentieth century was never quite the real thing. Nevertheless, the advantages of pursuing a scientific research career far from the metropole was the absence of peer pressure, and as sociologists of science have argued, that this created the possibility of idea hybridisation at the periphery (Chayut 1994). This resulted in the creation of disciplines such as theoretical astrophysics in Calcutta, and renormalisation theories of physics in Tokyo (DeVorkin 1989; 1994).

The history of modern science in India during the last decades of the nineteenth century and the early decades of the twentieth century is of interest as Indians schooled in modern science struggled to inaugurate a scientific and technological research system. The purported objective was to draw India closer to the international community of science. The first generation of Indian scientists have acquired an iconic place within this narrative of the institutionalisation of modern science. These scientists were embarking on an unenviable project of building bridges between the science they were pursuing and the knowledge forms that were part of the cultural life of the region before colonialism (Habib/Raina 1989).

The expansion of modern science reconsidered

This brings us to reconsider the question of the expansion of »Western science«, and the globalisation of science itself. Perhaps the expansion of »Western science« cannot be looked upon as the replication and reproduction of a paradigmatic version of science that emerged in Northern Europe in the seventeenth and eighteenth centuries. Sociologists working within the frame of multiple modernities do not look upon contemporary modernity as the product of the migration and subsequent reinvention of a paradigmatic version of Western modernity. On the contrary we have a much more complex process, wherein modern science encounters other

knowledge forms and local versions of modern science taking root there. This encounter metamorphoses modern science. There is a tendency among theorists of modernity to see the local forms of scientific knowledge as the product of pre-modern knowledge forms and practices persisting within modern science and preventing the realisation of the agenda of truly modern science. But these local versions or regional variations in the forms of knowledge and practices are embedded in diverse cultural and political environments that manifest themselves in the diverse organisation of pedagogical and evidential cultures. Under the microscope the purely normative account of the globalisation of Western science begins to exhibit distinct regional adaptations, rather than homogenisation on the Western model.

Furthermore, recipient cultures and nations proffer varying constraints and possibilities for the development of scientific institutions, thoughts and practices. In this manner local forms of science grounded in locally acquired knowledge develop. The problematic posed by earlier stories of the expansion of the dominion modern science, were that its sources were ascribed to Europe and networks of European scientists. This knowledge was imputed a status of being more universal than the empirical traditions encountered elsewhere. The natural evolution of social scientific research, accompanied by the changing global political order opened up a space for a multiplicity of voices that rendered visible the engagement of non-European scientific communities with the encounter of distinct knowledge systems. While this is embraced within the expanding envelope of »universal science«, stories about this creative process are founded on selection principles that filter out the diverse social and cultural contexts that shape the production of this knowledge.

The traditional tale has thus to be readapted depending upon whether we commence with the trope of the »original home of modern science«, or we commence with an evolutionary perspective of several sciences in a constant relation of exchange that result in global science. If we were to commence with the former, then modern science emerged in a specific historical context of Western Europe. On expanding into other cultures it undergoes a dual process of universalisation and localisation. One version of the standard tale would have us believe that the process of universalisation is nothing other than a replication of the self-same. On the other hand, as a multiplicity of local knowledge forms interface with universal science they are constantly changing the face of universal science. By confining the idea of the universality of science within parenthesis a number of rich veins of historical investigation open up.

Does abandoning the idea of the universality of science lead us into the trap of localism? I have attempted to suggest that universality is not given a priori but is constantly refurbished and thus evolving in time. The current preoccupation with scientific and cultural practices, the renunciation of the tropes of »original texts« and »original homes« of science, and a critical awareness of the categories and theoretic-

cal constructs we employ may yet lead us onto a more cognitively adequate and interesting version of the transmission of scientific and technological knowledge.

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