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Colonial Encounters and the Forging of New Knowledge and National Identities: Great Britain and India, 1760–1850

*Kapil Raj**

ABSTRACT

In opposition both to the dominant vision of colonial science as an hegemonic European enterprise whose universalization can be conceived of in purely diffusionist terms, and to the more recent perception of it as a simple reordering of indigenous knowledge within the European canon, this essay seeks to show the complex reciprocity involved in the making of science within the colonial context. Based on the example of India during the first century of British colonial conquest, it examines the specificities of intercultural encounter in the subcontinent, the formalized institutions that were engendered, and the kinds of knowledge practices that emerged in the case of the geographical survey of India. The essay suggests that the knowledge created in this context is not just local in character, but participates wholly in the emergence of universal science, as well as of other institutions of modernity.

INTRODUCTION

OVER THE LAST DECADE, PROMINENT IMPERIAL HISTORIANS have called into question the concept of simple diffusion of the fundamental values of modernity from Britain to its colonies—values such as democracy, justice, and the welfare state. They have argued that modernity and its institutions are not a simple emanation from a well-defined center, but are the result of adaptations and accommodations of British institutions confronted with the social, political, and economic organization of the countries Britain came to dominate, including Ireland, Scotland, and India. They thus imply that Britain, its modern institutions, and its empire were co-constituted.¹

However, modern knowledge and its making did not figure among the domains these authors studied. This lacuna has now been partially filled by Christopher Bayly

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¹ I refer here to historians like David Washbrook, Burton Stein, David Cannadine, and, most notably, Christopher Bayly. See his *Imperial Meridian: The British Empire and the World, 1780–1830* (London: Longman, 1989).

with his recent *Empire and Information*.² In a move away from the coproductivist perspective of his earlier works, Bayly here surveys the complex indigenous information-gathering networks of precolonial India—ranging from gossipmongers in the bazaars, marriage makers, and midwives to astronomers, physicians, and philosophers—and the historical contingencies that led to their partial, though informal, inclusion in the surveillance systems set up by the British following their rise to power in the latter half of the eighteenth century. “The colonial information order,” Bayly states, “was erected on the foundations of its Indian precursors . . . reclassified and built into hierarchies which reflected the world view of the Britons.”³ However, riven by mutual suspicion, distortion, and violence between the British officials and their indigenous informants, the new colonial state’s intelligence systems were fragile. The whole enterprise resulted in a monumental failure when the British were caught almost completely unawares by the popular rebellions and mutinies of 1857, which almost cost them their South Asian empire.

Bayly, however, does not deal with the workings of other, more successful and resilient institutions devoted to knowledge making and dissemination on which the colonial information order equally depended. Indeed, the late eighteenth century saw the rise, both in Britain and in its colonies, of a number of field sciences that at once fed on and reinforced the colonial order, such as geographical surveying, agriculture, botany, forestry, and anthropology.⁴

To be sure, Bayly does discuss debates *about* science and the status of scientific knowledge among learned Indians and British in the nineteenth century, but this is a second-order discussion, one step removed from the making of new knowledge.⁵ Moreover, Bayly’s approach is inadequate for studying the development of these sciences during this period. For a start, Britons themselves were in the process of forging a national identity; to speak of a single British world view at the time, into which indigenous knowledge was incorporated, is anachronistic.⁶ In addition, the field sciences developed in a much tighter, more formal, and stratified institutional context than the informal networks of intelligence-gathering at the heart of Bayly’s new work. Indeed, the successful functioning of these institutions presupposed the imposition of a certain authority by the state, a degree of control that was beyond the means (and ambitions) of individuals and their informal networks.⁷ And, although colonial institutions grew out of preexisting administrations of indigenous regimes and inherited much of their workforces, they were transformed by the new situation through mechanisms of accommodation and negotiation, producing novel forms of knowledge that were not simply linear offshoots of past practices and traditions. Study of colonial institutions thus calls for an approach that, by bringing negotiation

² Christopher Alan Bayly, *Empire and Information: Intelligence Gathering and Social Communication in India, 1780–1870* (Cambridge: Cambridge Univ. Press, 1997).

³ *Ibid.*, p. 179.

⁴ Simon J. Schaffer, “Field Trials, the State of Nature and British Colonial Predicament,” paper presented at the “Science and Empire” seminar, Centre de Recherche en Histoire des Sciences et des Techniques, Cité des Sciences et de l’Industrie, La Villette, Paris, 11 June 1999.

⁵ Bayly, *Empire and Information* (cit. n. 2), chaps. 7 and 8.

⁶ See Linda Colley, *Britons: Forging the Nation 1707–1837* (New Haven and London: Yale Univ. Press, 1992). See also Roy Porter and Mikuláš Teich, eds., *The Scientific Revolution in National Context* (Cambridge: Cambridge Univ. Press, 1981).

⁷ See Svante Lindqvist, “Labs in the Woods: The Quantification of Technology During the Swedish Enlightenment,” in *The Quantifying Spirit in the Eighteenth Century*, eds. Tore Frängsmyr, John L. Heilbron, and Robin E. Rider (Berkeley: Univ. of California Press, 1990), pp. 291–315.

and coproduction back to center stage, accounts for the complex character of knowledge making and circulation during this period—an approach closer to Bayly's earlier works as well as to recent work in the history and sociology of science.

From the mid-eighteenth to the mid-nineteenth centuries, the Indian subcontinent played an important and active role in this coemergence inasmuch as it became a space for multiple cultural encounters in the context of empire: encounters between different groups from the British Isles, and between them and different sectors of the subcontinent's own population. Corresponding to these two different types of encounters, the first part of this essay, situated mainly in Calcutta, presents the specificities of scientific practices and the circumstances that led to their institutionalization. The second focuses on one institution—the Survey of India—to show its hybrid nature and the coproduction of geographical knowledge that emerged.⁸ I shall conclude by addressing questions related to the nature and scope of the knowledge produced in the co-construction of modernity across the globalized space of empire.

THE EAST INDIA COMPANY, CALCUTTA, AND THE COLLEGE

Direct contact between England and India dates from the establishment of the English East India Company in 1600. Coming to participate in the lucrative spice and luxury commodity trade, the English initially represented no more than a few hundred civilians and a couple thousand troops. Even at the apogee of empire in the twentieth century, the British presence in India never exceeded a few tens of thousands of civilians, a number at all times too small not to rely heavily upon autochthonous intermediaries for most administrative and technical tasks.⁹ In fact, from their arrival in the subcontinent, a collaboration was established between the British and segments of the region's population: *banians* (bankers) and *munshis* (interpreter-secretaries), and skilled workmen like weavers, jewelers, carpenters, shipbuilders, and sailors. In the face of inter-European rivalries in the second half of the eighteenth century, especially vis-à-vis the French, this collaboration extended to the establishment of an army that included indigenous troops, artificers, and gunsmiths.

The conquest of Bengal in 1757 put the British firmly on the road to territorial and political power. However, consciousness of this new role was slow in coming for, in the years that followed, East India Company officials devoted their attention to unbridled personal profiteering through looting and extorting exorbitant taxes from the local peasantry. But after ten million lives had been lost in the space of three years—victims of a famine that was a direct consequence of the ruthless policies of the company's servants—parliament in Britain pressured the company to establish more orderly and permanent forms of exploitation and government.

So it was that Warren Hastings, governor-general of Bengal from 1772 to 1785, received orders from London to take over the whole civil administration of the

⁸ I have chosen this institution partly to provide a counterpoint to Matthew Henry Edney, *Mapping an Empire: The Geographical Construction of British India, 1765–1843* (Chicago and London: Univ. of Chicago Press, 1997), the argument of which is largely founded on Bayly's central thesis in *Empire and Information* (cit. n. 2).

⁹ One estimate, made for the Madras presidency during the first half of the nineteenth century, put the proportion of Britons to South Asians directly serving the company's civil administration at 1 to 180. See Robert E. Frykenberg, *Guntur District 1788–1848: A History of Local Influence and Central Authority in South India* (Oxford: Clarendon Press, 1965), p. 7.

province. As the emerging state of Great Britain held that civil justice, public order, transport, and communications depended upon taxation, Hastings took the orders to mean the entire management of the province's revenues.¹⁰ The collaboration between Britons and South Asians thus broadened to include tax collection and running a civil government. And although the British set up a variety of new intermediary relationships, their interlocutors remained in large part the indigenous "under civil servants"—land-revenue officials, minor judges, and police officials inherited from the Mughal and other princely administrations.

To Hastings's mind, successful administration required drawing up a kind of Domesday Book of the company's territories. "Every accumulation of knowledge," he wrote, "and especially such as is obtained by social communication with people over whom we exercise a dominion founded on the right of conquest, is useful to the state. . . ." ¹¹ In addition to taxation and law, this knowledge was to include natural history and antiquities, local customs, diet and general living conditions—in short, all that would, by the end of the century, go under the name of "statistics." Giving the highest priority to a knowledge of languages, Hastings devised handsome monetary incentives for those officials willing to study Indian languages and culture. This policy constituted the first step in the transformation of the European study of exotic peoples from an individual avocation to a massive and institutionalized activity, reflecting how vital a concern it was for the emerging rulers of the subcontinent.

However, not all of the East India Company's agents had the wherewithal to take up Hastings's offer. The vast majority of recruits to the company arrived in India between the ages of fourteen and eighteen.¹² The only prerequisite for recruitment was knowledge of "the rule of three and merchants accounts."¹³ Few of the English had been to university. Engrossed in fortune making in this "fine country for a gentleman to improve a small fortune in," most had little curiosity about the subcontinent's inhabitants nor, indeed, the culture to acquire learning.¹⁴

Of the minority of Englishmen who did have a penchant for intellectual pursuits, most were, in the fashion of the "great school" and Oxonian, High-Church elite to which they generally belonged, obsessed with classical thought and scripture. Indeed, their education was dominated by the study of Greek and Latin, and by the "grand tour" of Italy and Greece.¹⁵ Their attitudes towards politics and government,

¹⁰ See John Brewer, *The Sinews of Power: War, Money and the English State 1688–1783* (London: Unwin Hyman, 1989), and Georg Robert Gleig, ed., *Memoirs of the Life of Right Honourable Warren Hastings*, 3 vols. (London: Richard Bentley, 1841), vol. 1, p. 214.

¹¹ Warren Hastings to Nathaniel Smith, chairman of the East India Company, 4 Oct. 1784, reprinted in Charles Wilkins, trans., *Bhagavad Gita* (London, 1785), preface, p. 13.

¹² India Office Records, Court Minutes 1784–85: B/100, p. 216, British Library, London (hereafter cited as India Office Records).

¹³ Writers' petitions and educational testimonials for recruitment into the East India Company quoted in Anthony Farrington, *The Records of the East India College Haileybury & Other Institutions* (London: Her Majesty's Stationery Office, 1976), p. 4.

¹⁴ James Rennell to the Rev. Gilbert Burrington, 7 Nov. 1763, India Office Records, MSS Eur/D1073.

¹⁵ For a description of the daily life of the British in India during this period, see Percival Spear, *The Nabobs* (Oxford: Oxford Univ. Press, 1963). For eighteenth-century classical education in Britain, see Robert Maxwell Ogilvie, *Latin and Greek: A History of the Influence of the Classics on English Life from 1600 to 1918* (London: Routledge and Kegan Paul, 1964), pp. 46 ff. See also John Harold Plumb, *Men and Places* (London: Cresset Press, 1963), and John Lawson and Harold Silver, *A Social History of Education in England* (London: Methuen, 1973).

conduct, manners, and style testify to the influence of the classical disciplines. Not surprisingly, in their eyes, Sanskrit was to Indian vernaculars what Greek and Latin were to contemporary European languages. Like their virtuoso contemporaries in Europe who invested in recovering the works of ancient Greece and Rome, they concentrated, in their exploration of Indian learning, on ancient Sanskrit literary, philosophical, and scientific works. Naturally, they sought as informants and privileged interlocutors their Indian counterparts—those of the Brahminical upper castes who had mastered Sanskrit, and *maulavis* (Muslim law-officers) and *munshis* adept in Arabic and Persian—a reliance that reinforced their classical inclinations. Their understanding of the contemporary society that they were supposed to govern was shaped by a scrutiny of classical texts and of texts specially commissioned to be written, in Sanskrit, by their Brahminical collaborators.

The *Vivādabhangārṇava* (Treatise on putting an end to litigation) by Jagannātha Tarkapanchānana, a venerable professor of law and legal expert to the Calcutta Supreme Court, is a typical example of the new type of collaboration. A hybrid text constructed jointly by the British jurist Sir William Jones and Jagannātha's team of court-pundits (native legal assistants), it went well beyond the scope of preexisting Hindu law manuals.¹⁶ Because of its comprehensiveness and the immense authority Jagannātha commanded among his colleagues, pupils, and the Bengali public, this work was widely used by Indian court assistants and British judges alike. It was also to serve as a model for a spate of supplementary compositions by pundits in the employ of British-administered courts. These works, in turn, formed a corpus prescribed in the syllabus of the Sanskrit College in Banaras, established in 1794 to breed a new generation of pundits "to assist the European judges in the due, regular, and uniform administration of [the] genuine letter and spirit [of Hindu law] to the body of the people."¹⁷

If the classicists were mainly trained in the English public schools and at Oxford and Cambridge, men of science, law, and medicine were mostly trained either in the dissenting academies or in the Scottish and Dutch universities.¹⁸ Indeed, in Scotland's more egalitarian Presbyterian tradition, many more men went to university than in England, and at a much earlier age. Moreover, Scottish education, both at school and university, was much broader than in England, covering (besides Latin and Greek) history, navigation, geography, mensuration, and natural and moral philosophy.¹⁹ However, Scotland itself did not have the capacity to absorb its qualified workforce, which consequently emigrated to England and beyond.²⁰ A large number

¹⁶ For a list of expressly commissioned works, see J. Duncan M. Derrett, "Sanskrit Legal Treatises Compiled at the Instance of the British," *Zeitschrift für vergleichende Rechtswissenschaft*, 1961, 63:72–117. For an evaluation of the nature of the *Vivādabhangārṇava*, see *idem*, *Religion, Law and the State in India* (London: Faber & Faber, 1968), pp. 247–8.

¹⁷ Jonathan Duncan, Resident Benares, to the Earl of Cornwallis, Governor-General, 1 Jan. 1792, in *Selections from Educational Records*, ed. Henry Sharp, 2 vols. (Calcutta: Superintendent Government Printing, 1920), vol. 1, p. 11.

¹⁸ See Nicholas Hans, *New Trends in Education in the Eighteenth Century* (London: Routledge and Kegan Paul, 1951), pp. 32–6.

¹⁹ See Paul Wood, "The Scientific Revolution in Scotland," in Porter and Teich, *The Scientific Revolution*, (cit. n. 6), pp. 263–87.

²⁰ Francis Buchanan is a good illustration of this. See Marika Vicziani, "Imperialism, Botany and Statistics in Early Nineteenth-Century India: The Surveys of Francis Buchanan (1762–1829)," *Modern Asian Studies*, 1986, 20, 4:625–60.

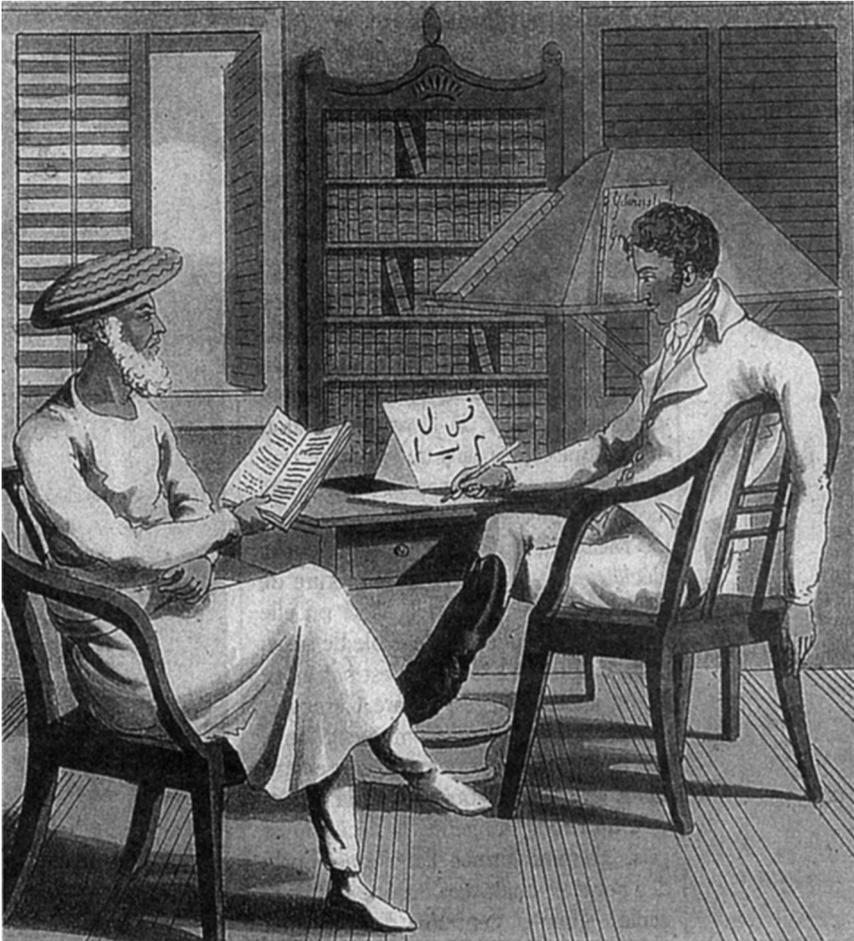


Figure 1. “An European Gentlemen with his Moonshee, or Native Professor of Languages” from Charles Doyley, *The European in India* (London: Edward Orme, 1813), frontispiece. (British Library, India Office Collections.)

were absorbed into Britain’s ever-expanding colonial services, to occupy senior technical positions as engineers, soldiers, veterinarians, diplomats, doctors, and naturalists. Indeed, it was predominantly the Scots who manned the highly successful operational, scientific, and technological aspects of British activity in India.

Thus, Scottish medical officers of the company were the first to systematically make meteorological recordings in India, while another Scot, Robert Kyd, set up the Botanic Gardens in Calcutta that William Roxburgh consolidated, assisted by William Hunter, James Anderson, and Francis Buchanan. John McClelland headed the first committee for the exploration of mineral resources. Buchanan and Colin Mackenzie were among the pioneers of large-scale topographical surveys in the subcontinent, and David Ross was called to teach natural and experimental philosophy when the Hindu College was set up in Calcutta in 1817. As army medics, Scots came to learn the vernaculars of the subcontinent. Many mastered Persian and Arabic, the court languages of Mughal India, and with the help of Persian *munshis* compiled

bilingual dictionaries and translated texts. Diplomatic missions were thus often entrusted to them: Alexander Hannay to the Mughal court; George Bogle, Alexander Hamilton, and Samuel Turner to Tibet.

However, linguistic ability was not the prerogative solely of the High-Church Englishmen or opportunistic Scots. Another group—Baptist missionaries—was also busy discovering the languages of the subcontinent's inhabitants. Persecuted like other nonconformists in England during this period, a few sought refuge in India, establishing themselves at the Danish colony of Serampore near Calcutta.²¹ Under William Carey, a Baptist fugitive turned indigo factory owner and small-time tradesman, they tried to introduce the Bible to the crafts-oriented lower castes through an understanding of their languages and ways of life.²² With their populist notions, they mastered a large number of the subcontinent's vernaculars and gained deep insights into its cultures. They, too, were to write grammars of Indian languages and collect folk tales and other lore, the better to understand the people they set out to proselytize. In 1800, the Serampore missionaries founded a printing press where, with their indigenous interlocutors, they cast fonts of many Indian vernaculars. This press was the first and most important in its time for books in living oriental languages.

Developments at the turn of the nineteenth century were to bring these different British groups and their respective indigenous collaborators together in a formalized institutional context. In an effort to stem the spread among its employees of the "erroneous principles of the same dangerous tendency [as the doctrines of the French Revolution]," which "had reached the minds of some individuals in the civil and military service of the Company in India," and instead "to fix and establish sound and correct principles of religion and government in their minds at an early period of life," the East India Company set up a college at Fort William, Calcutta in 1800.²³ Newly arrived, covenanted officers of the East India Company were to spend three years in residence at this "University of the East", "removed from the danger of profusion, extravagance and excess."²⁴ They studied Hindu, Islamic, and English law; civil jurisprudence, political economy, general history, world geography, and mathematics. The rigorous curriculum also included natural history, botany, chemistry, astronomy, Latin, Greek, Sanskrit, Arabic, Persian, and modern European languages in addition to the culture and the six major languages of their South-Asian subjects (Hindustani, Bengali, Telugu, Marathi, Tamil, and Kannada).²⁵ Many of these subjects and languages had never before been taught in Britain or in Europe at any level. The college, which cost £250,000 in its first three years alone, soon grew to a size comparable to its models—contemporary Oxford and Cambridge.²⁶

In order to teach these various subjects, staff members were recruited from among

²¹ See Michael Watts, *The Dissenters from the Reformation to the French Revolution* (Oxford: Oxford Univ. Press, 1978).

²² William Carey, *An Enquiry into the Obligations of Christians to Use the Means for the Conversion of the Heathens*, new facsimile ed. (London: Carey Kinggate Ltd., 1961), p. 74.

²³ Quotations from Wellesley's "Minutes on the Foundation of a College at Fort William, 10 July 1800," reprinted in *The Despatches, Minutes and Correspondence, of the Marquess Wellesley, K. G., During his Administration in India*, ed. Robert Montgomery Martin, 5 vols. (London: W. H. Allen & Co., 1836), vol. 2, p. 346.

²⁴ *Ibid.*

²⁵ "Regulation for the Foundation of a College at Fort William . . . Passed by the Governor-General in Council, on the 10th July, 1800 . . ." in *ibid.*, vol. 2, p. 359 ff.

²⁶ Farrington, *Haileybury Records* (cit. n. 13), p. 6. See also David Kopf, *British Orientalism and the Bengal Renaissance: The Dynamics of Indian Modernization 1773–1835* (Calcutta: Firma KLM,

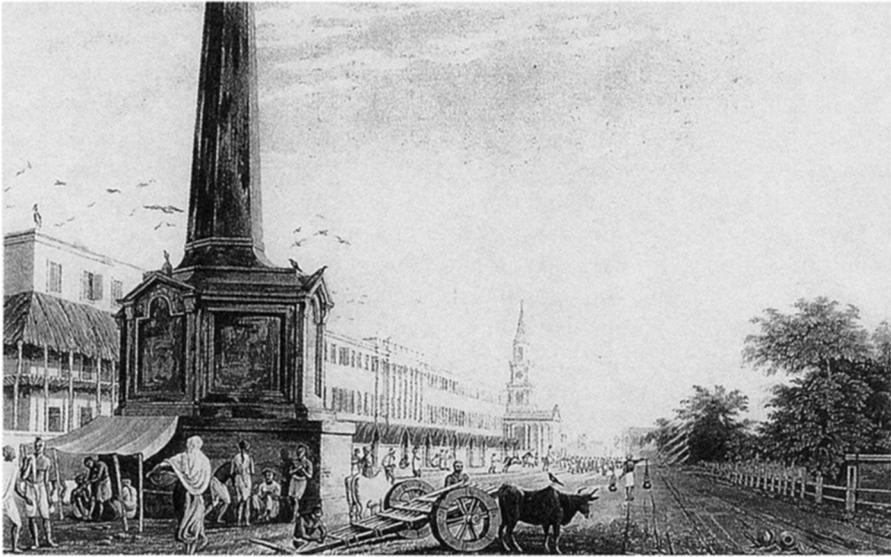


Figure 2. *The Public Exchange and Coffee-House Building, behind Tank Square, where the College of Fort William was first housed before being shifted (around 1806) to the Writers' Buildings (below), on the opposite side of the square. From James Baillie Fraser, Views of Calcutta and its Environs (London, 1824–1826), plates 22 and 6. (British Library, India Office Collections.)*

the British in Calcutta. Persian was entrusted to Neil Edmonstone, Arabic to John Baillie, Hindustani to John Gilchrist (Scotsmen all), Sanskrit to Henry Thomas Colebrooke, and the five remaining Indian vernaculars to the Baptist William Carey (thereby giving the Baptists a fig leaf of respectability in exchange for their knowledge about indigenous cultures that was inaccessible to official Indo-British culture). Natural and experimental philosophy were taught by a Scotsman, James Dinwiddie. A number of Indians, both Hindus and Muslims, were recruited to assist the Euro-

pean staff members and very often taught in their place.²⁷ It was this institution that provided the first sustained, professional contact between the different “confessional nations” of the British in India.

In addition to teaching, the college organized and sponsored expeditions in company-controlled territories in order to discover and catalogue manuscripts for its library. By 1805, its Indo-British staff had succeeded in encoding a number of spoken languages of the subcontinent into grammatical forms, and translating them into English. The College of Fort William was the first of a series of institutions in which these different knowledge traditions and their corresponding skills were brought together, standardized, and rendered teachable. When in 1806 the company’s Court of Directors set up the East India College at Hertford Castle (later transferred to Haileybury) in England as a preparatory school for new recruits before they left for India, some of the staff members of Fort William and their hybrid networks were transferred to the metropolis to teach alongside the mathematician Bewick Bridge, FRS and fellow of Peterhouse, Cambridge; the jurist Edward Christian, Downing Professor of Law at Cambridge, and the political economist Thomas Malthus.²⁸

This focus on Calcutta reveals some of the contingencies that shaped the multicultural encounters, and the integration of the resulting networks into the newly emerging academic system of metropolitan Britain. A brief look at one of the principal, and undoubtedly the most prestigious, colonial scientific institutions—the Survey of India, also established in the latter half of the eighteenth century—throws similar light on the nature of intercultural collaboration and the kind of knowledge that resulted.

INDIA AS A SOURCE OF NEW SCIENTIFIC PRACTICES AND KNOWLEDGE MAKING

In the course of the seventeenth and eighteenth centuries the British, like other Europeans trading with the East, charted the seas and coasts between western Europe and Asia. However, they had little knowledge of the geography of mainland South Asia. For this, they relied principally upon information culled from travelers and missionaries, and on the occasional map, like that of the French armchair mapmaker Jean-Baptiste Bourguignon d’Anville, who in 1752 had published a *Carte de l’Inde* based on European travelers’ accounts. Territorial acquisition changed needs and, in the wake of the conquest of Bengal, surveys of the new possessions were ordered to defend frontiers, to ascertain the extent and revenue potential of cultivated lands, and to ensure the safety and regularity of communications.

Like other British colonial institutions, the Survey of India had to rely upon indigenous staff members and their skills. Not only were the British too few to undertake surveys, but those few had little or no experience in countrywide terrestrial surveying. In the 1760s, when survey work was first undertaken in India, there was no unified, detailed map of the British Isles—with the notable exception of a map of Scotland, made by Scotsmen in the aftermath of the 1745 uprising—although there was no dearth of coastal, harbor, and fortification maps made for the Board of Ord-

²⁷ See Bernard S. Cohn, “The Recruitment and Training of British Civil Servants in India, 1600–1860,” in *idem, An Anthropologist Amongst the Historians and Other Essays* (New Delhi: Oxford Univ. Press, 1989), pp. 500–53, especially pp. 529 ff.

²⁸ “Staff of the East India College, Haileybury,” in Farrington, *Haileybury Records* (cit. n. 13), pp. 104–6.

nance, and estate, route, and county maps in the civilian domain. The latter were based on measurements made by estate and county surveyors whose skills and instruments, besides being unavailable in India, were inadequate for the purposes of extensive surveying. Indeed, the Ordnance Survey of Great Britain and Ireland was founded only in 1791, and it was not until 1801 that the first ordnance map appeared.²⁹

Like the British, the Indians possessed no detailed maps of the whole of the sub-continent, although there is evidence of maps for the northwestern, central, and western parts dating to the sixteenth and seventeenth centuries. These do not show a uniform scale or orientation and their exact use is not known.³⁰ At any rate, the need for maps in precolonial India seems to have been obviated by gazetteers and manuals, used for administration and revenue collection, that provided systematic descriptions, in tabular form, of provinces and their subdivisions, noting their general location and territorial extent. The most famous of these was the *Ain-i Akbari* (Institutions of Akbar) made for the Mughal Emperor Akbar (1542–1605; reigned from 1556), who had his roads measured with great care. The Jesuit Antonio Monserrate (1536–1600), who spent many years in Akbar's court, describes the measurement of the latter's march to Kabul in Afghanistan in 1581:

[Akbar] orders the road to be measured, to find the distance marched each day. The measurers, using ten-foot rods, follow the king, measuring from the palace. By this one operation he learns both the extent of his dominions, and the distances from place to place, in case he has to send embassies or orders, or meet some emergency. A distance of 200 times the ten-foot rod, called the *coroo* in Persian, or *cos* in the Indian language, equal to two miles, is the measure for calculating distances.³¹

There was also a well-established tradition of land measurement and surveying for the purposes of establishing property rights and fiscal dues. An eighteenth-century Sanskrit manuscript on land measurement from peninsular India, translated for the Moravian missionary, naturalist, and surveyor for the East India Company Benjamin Heyne (1770–1819), describes a method based on the use of corporeal and other techniques:

The fundamental measure is that of an Inch which is determined in three different ways.

First, By placing three rice corns in a line length ways—the place they occupy is called an Inch.

²⁹ Almost all of the 184 eighteenth-century British surveyors in India picked up surveying and mapmaking techniques on the job. See Reginald Henry Phillimore's authoritative study, *Historical Records of the Survey of India*, 5 vols. (Dehra Dun, India: Survey of India, 1945–1968), vol. 1, "Biographical Notes," pp. 307–400. For a history of the survey of Scotland and the techniques employed, see Raleigh Ashlin Skelton, "The Military Survey of Scotland 1747–1755," *The Scottish Geographical Magazine*, 1967, 83:1–15. For the early history of surveying in England, see Charles Close, *The Early Years of the Ordnance Survey* (Newton Abbot, U.K.: David and Charles Reprints, 1969) and W. A. Seymour, ed., *A History of the Ordnance Survey* (Folkestone, U.K.: William Dawson, 1980).

³⁰ See Joseph E. Schwartzberg, "South Asian Cartography," in *The History of Cartography*, eds. John Brian Harley and David Woodward, vol. 2, book 1: *Cartography in the Traditional Islamic and South Asian Societies* (Chicago and London: Univ. of Chicago Press, 1992), pp. 400 ff.

³¹ Antonio Monserrate, "Mongolicae Legationis Commentarius," trans. and cited by Phillimore, *Historical Records* (cit. n. 29), vol. 1, p. 10.

Secondly, By measuring the circumference of the second joint of the thumb, half of the length of which is an Inch.

Thirdly, By measuring the second joint of the middle finger, the half of which is called an Inch.

12 of these Inches are One Jana (literally translated as paw)—32 Janas are One Ghada (or Bamboo)—4 Ghadas (or One Square Bamboo) is One Kunta.

These measures . . . are universally understood.³²

The mapping of India started by mobilizing available resources. The French savant-traveler Abraham-Hyacinth Anquetil-Duperron (1731–1805) has left the following amusing account of an early (1758) European military route survey:

I have traveled in the interior of India alone, with others and with the army. The commanding officer spends the better part of his day sleeping in his palanquin. At dinner he asks his *Dubash* [interpreter] . . . what distance they have traveled and which places they have passed. The latter in turn asks the porters or else replies himself, for reply one must; and the distances and place names are inscribed on the itinerary, on the map . . . (which, by the way, I found perfectly well made).³³

James Rennell (1742–1830) can be considered the first Englishman to have brought these disparate traditions together on the same map. Rennell started his career as an ensign on a British naval vessel off the coast of Brittany during the Seven Years' War (1756–1763). There he learned the art of coastal and harbor surveying, a skill he was to use to great advantage during his thirteen years in the service of the East India Company as surveyor-general of Bengal. Indeed, since the Ganges-Brahmaputra delta forms a large part of this territory, Rennell used its navigable distributaries in the same way as one would a sea coast, tracing an outline of the whole delta.³⁴

For the terrestrial cartography, Rennell sent both Indian and British soldiers on long route marches. From their accounts, as well as those of other Asian and European travelers and missionaries, he began compiling his map of the whole subcontinent. Foremost among the contributors were Ghulam Mohammad for peninsular India, Mirza Mughal Beg for northwestern India, and Sadanand for Gujarat.³⁵ His European informants consisted mainly of the Jesuit Fathers Antonio Monserrate and Joseph Tieffenthaler (1710–1785), and Frenchmen in India like Claude Martin (1735–1800)—who themselves relied on “native” surveyors.³⁶ And, of course, Rennell extensively used the tables of the *Ain-i Akbari*. Interestingly, he acknowledged

³² “The ‘Chetrie Ganietam’—A Sanskrit Work on Land Measurement Translated by Benjamin Heyne,” *Memoirs of the Survey of India (1773–1866)*, Memoir 3, f. 2, National Archives of India, New Delhi.

³³ Translated by the present author from the original French published in Jean Bernoulli, ed., *Description historique et géographique de l'Inde*, 3 vols. (Berlin: Pierre Bourdeux, 1786–1788), vol. 2, pp. 466–7.

³⁴ See Rennell's correspondence with his guardian, the Rev. Gilbert Burrington, India Office Records, MSS Eur/D1073; and his manuscript maps held at the Royal Geographical Society Archives, London.

³⁵ James Rennell, *Memoir of a Map of Hindoostan, or the Mogul's Empire*, 1st ed. (London: for the author, 1783), pp. vi, 66 n., 69; and *idem*, *A Bengal Atlas: Containing Maps of the Theatre of War and Commerce on that Side of Hindoostan* (London, 1781), p. x.

³⁶ Bernoulli, *Description historique* (cit. n. 33), vol. 1, p. ix.



Figure 3. Frontispiece to James Rennell, *Memoir of a Map of Hindoostan* (London: for the author, 1783). (British Library, India Office Collections.)

all his sources in the introduction to the memoir that accompanied his map of India, published in 1783. In the frontispiece to the first edition, one can see an open acknowledgement of the cooperation between Indian and British elites: a Brahman giving sacred manuscripts (*Shastras*) to Britannia while other Brahmans, each loaded with manuscripts, patiently await their turn. This map was much more dense with information than any so far made of Britain or of its overseas territories, and would serve as a model of detail and accuracy for the future mapping of Britain itself.

In recognition of his achievements, Rennell was awarded the Copley Medal of the Royal Society in 1791. On the occasion, Sir Joseph Banks, the society's president, proclaimed:

Would I could say that England proud as she is of being esteemed by surrounding nations the Queen of Scientific improvement, could boast of a general Map as well executed as the Majors [Rennell's] delineation of Bengal and Baher [*sic*], a tract of Country considerably larger in extent than the whole of Great Britain and Ireland . . . the accuracy of his particular surveys stands unrivalled by the most laboured County Maps this nation has hitherto been able to produce.³⁷

And if Banks's plea was answered that very year with the founding of the Ordnance Survey, the surveying techniques and instruments used in Britain were very different from those developed in India. While triangulation was adopted as the sole technique of extensive surveying in Britain, it was Rennell's composite method of data collection that was extended by his successors in India. Thus, Thomas Call (surveyor-general of Bengal, 1777–1788) employed at least forty Indians to collect information for his "Grand Atlas of India."³⁸ And when triangulation was introduced to the subcontinent, it was just one—albeit important—technique, used alongside others such as pacing and reckoning distance as a function of time (with the day's march as the common unit). The task of translating and arranging reports into maps was not a simple one, as a whole gamut of special procedures and protocols had to be constructed. Charles Reynolds (surveyor-general of Bombay, 1796–1807), who organized a series of survey teams composed exclusively of South Asians to crisscross the subcontinent, wrote to superiors who were anxious at the size of his budget, "The[ir] surveys cannot be rendered to use if they are taken down and translated by any other than a person conversant with the business."³⁹

In the following decades, new methods for the reproduction of maps were developed for use in the Survey of India. For instance, the first-ever use of lithography in map printing was in Calcutta in 1823.⁴⁰ The adaptation, maintenance, and repair of instruments often involved modifications of their structure and protocols for use, and hence recalibration. For instance, the English perambulators were found to be "flimsy, bad in principle, and incapable of working except on a smooth road or bowling green; across country they go to pieces in a mile or two."⁴¹ In the 1780s a Captain John Pringle of the Madras Infantry designed an instrument that was more resilient and better suited to the stature and gait of Indian *lascars* (footmen). By the mid-nineteenth century, the instrument, having undergone continuous modification, was still in use, but was very different in looks and operation from its English cousin.

³⁷ *Royal Society Journal*, 1790–1793, Book 34: 389–90.

³⁸ India Office Records, Bengal Public Consultations, 6 Oct. 1783 and 29 Nov. 1784: P/2/63 and P/3/7, respectively. A number of maps from similar surveys are held in the British Library, London, Add. MSS 13907 (a, b, c, d, e).

³⁹ India Office Records, Bombay Military Consultations, 13 Jan. 1807, cited by Phillimore, *Historical Records* (cit. n. 29), vol. 1, p. 288.

⁴⁰ See Andrew S. Cook, "The Beginning of Lithographic Map Printing in Calcutta," in *India: A Pageant of Prints*, eds. Pauline Rohatgi and Pheroza Godrej (Bombay: Marg Publishers, 1989), pp. 125–34.

⁴¹ Ralph Smyth and Henry Landour Thuillier, comps., *A Manual of Surveying for India, Detailing the Mode of Operations on the Revenue Surveys in Bengal and the North-Western Provinces* (Calcutta: W. Thacker and Co., 1851), pp. 360–1.

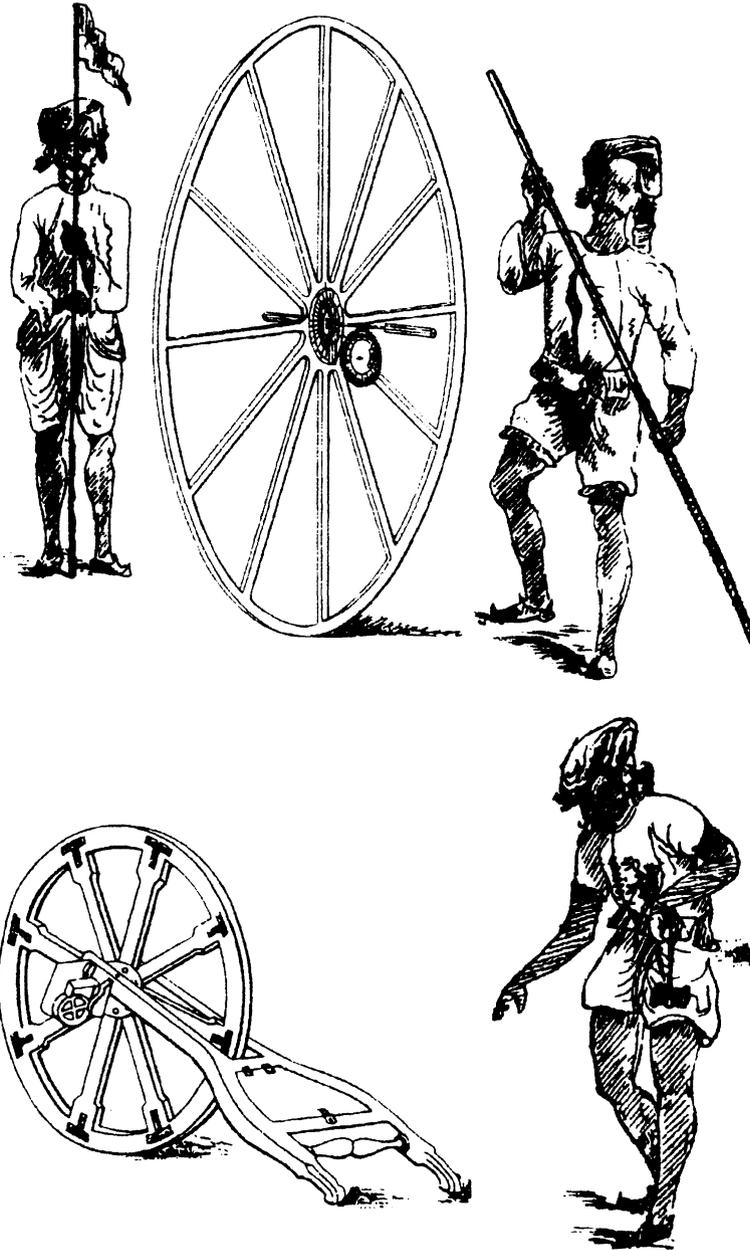


Figure 4. Some survey perambulators of the Survey of India: The Madras Pattern Perambulator introduced in 1780 (above) and the Everest Pattern Perambulator devised between 1832 and 1836 (below). Adapted by the author from Ralph Smyth and Henry Landour Thuillier, comps., *A Manual of Surveying for India, Detailing the Mode of Operations on the Revenue Surveys in Bengal and the North-Western Provinces* (Calcutta: W. Thacker and Co., 1851).

Novel survey methods had at times to be forged for terrains and circumstances that precluded the use of standard techniques—the mapping of central Asia in the 1860s using the rigorously calibrated pace of Indian surveyors is a good example.⁴² Indeed, so distinct were the practices of the Survey of India that when, in 1851, the Thomason Engineering College was established in Roorkee (northern India) to train surveyors, an entirely new manual had to be written, for “scarcely any of the English works on Geodesy extant, touch on, or afford any practical insight into, the system of Survey, as carried on and as peculiarly applicable to this country.”⁴³ More than half the book was written by Radhanath Sikhdar, the survey’s chief computer.

CONCLUSION

Beyond pointing to the inadequacy of the diffusionist, confrontationist, and “re-ordering of traditional knowledge” approaches to the spread of Western science, the case of India stresses the complexity and reciprocity involved in the construction of modern science, even in the asymmetrical colonial situation. It also points to the active role that the heterogeneous knowledge networks developed in India played in the forging of a British identity and research-and-teaching tradition in the early nineteenth century, a role that needs to be worked out in much greater detail than the scope of this essay allows.

However, the perspective adumbrated here implies an apparent paradox. As pointed out above, the material practices of the Survey of India differed in crucial ways from those of the Ordnance Survey of Great Britain and Ireland. Yet the knowledge produced out of these differing practices and protocols could be rendered commensurable and placed on the same map. How does the switch from these local practices to universal science operate?

In order to answer this, one has to distinguish between two aspects of science: its material and social practices on the one hand, and the knowledge to which they give rise on the other. While the former are always local—mapping procedures and protocols, for instance, have varied, and indeed continue to vary, between countries institutions, and even individual laboratories—knowledge is *made* universal through a series of mediations, measurement and its calibration being among them. It is through calibration that instruments or techniques developed in a given place can be compared with those developed in another place, that the results obtained through one set can be compared with those obtained through another set—and thus that contemporary science can claim to be universal.⁴⁴ In the case of the Indo-British surveys of India, it was precisely this operation of calibration that allowed data collected through such varied methods as Rennell’s translation of tabular data and Reynold’s assistants to be legitimately incorporated into a single map of the subcon-

⁴² See Kapil Raj, “La construction de l’empire de la géographie: L’Odyssée des arpenteurs de Sa Très Gracieuse Majesté, la reine Victoria, en Asie centrale,” *Annales Histoire, Sciences Sociales*, 1997, 5:1153–80; and *idem*, “When Humans Become Instruments: The Indo-British Exploration of Tibet and Central Asia in the Mid-19th Century,” in *Instruments, Travel and Science: Itineraries of Precision in the Natural Sciences, 18th–20th Centuries*, eds. Marie-Noëlle Bourguet, Christian Licoppe, and Hans Otto Sibum (Chur, Switzerland: Harwood Academic Publishers, forthcoming).

⁴³ Smyth and Thuillier, *Manual of Surveying* (cit. n. 41), p. iii.

⁴⁴ See Harry M. Collins, *Changing Order: Replication and Induction in Scientific Practice* (London: Sage, 1985), pp. 100–6.

continent, which in turn could be commensurated with other local, regional, and national maps into one of the world.

However, a word of caution needs to be immediately spelled out: if Indians and Britons mobilized and transformed their specialized practices for the common resolution of problems, this does not mean, as some historians have recently argued, that they participated equally in a dialogic process in an idyllic “commonwealth of letters.”⁴⁵ On the contrary, the kinds of knowledge discussed in this essay could only be constructed and sustained within a strong framework of formalized institutions with their imperatives of teamwork and a stratified division of labor. Hence, while the British and Indians collaborated in the making of new knowledge, their respective specialized practices were distinguishable and perfectly well hierarchized in the formal structures of teaching establishments, like the College of Fort William, and of science-dependent administrative organizations, like the Survey of India, creating a commonly made knowledge while creating different identities.

⁴⁵ See, for instance, Eugene Irschick, *Dialogue and History: Constructing South India, 1795–1895* (Berkeley, Los Angeles, London: Univ. of California Press, 1994) and Thomas R. Trautmann, “Hullabaloo about Telugu,” *South Asia Research*, 1999, 19, 1:53–70.