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INSTITUTIONS AND KNOWLEDGE: FRAMING THE TRANSLATION OF SCIENCE IN COLONIAL SOUTH ASIA

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Abstract

New epistemic regimes and institutional forms—it has been maintained for some time now—are co-produced. This paper seeks to examine the process of the colonial transplantation of a modern institutional structure for the reproduction and production of scientific knowledge in colonial India. This attempt at re-engineering the system of education was complicated not just by the diverse motivations of colonial officials, missionaries, British educationists and policy makers but was deeply entangled within local institutional frameworks and ways of knowing. This entanglement generated processes of domestication of institutions and of knowledge forms of British or European provenance that resulted in the very metamorphosis of these institutional and pedagogical structures. This paper attempts a genealogy of the entanglement of colonial knowledge and power with the aspirations of a modernizing class of colonial subjects who would transform these structures to fashion a new cultural identity and orient the university to other developmental agendas.

Introductory remarks

One of the most problematized themes in the history of sciences in the last couple of years has been that of the "circulation" and "flow" of ideas between East and West, Europe and non-Europe.[1] The particular point of departure of these new studies, distinct from earlier theories of the transmission or translation of scientific knowledge, has been to problematize the process itself in terms of the social and cultural, or to open the black box of what has been referred to as "cultural transmission" or "cultural translation". One of the departures was institutionally and thematically inaugurated in the Science and Empires program[2] wherein the attempt has been to detail the processes of exchange of scientific

1 Günergun / Raina, 2010; Raj, 2007; Renn, forthcoming.

2 Petitjean et al., 1992.

knowledge between modern Europe and the non-Western world. While the approaches to the problematic are manifold, they are held together by some common premises.

While recognizing that the nineteenth and early twentieth master narrative was founded on the idea of the cultivation of modern science in non-Western societies as part of the "civilizing mission", contemporary studies situate these accounts in the context of negotiations between the gate keepers of a multiplicity of concerned knowledge forms. This has entailed the adoption of a sociology of knowledge to unveil the politics of scientific knowledge. By the 1990s these developments crystallized into what has been alluded to as post-colonial history and theory of science.[3]

In the former historiography the agents or carriers of scientific knowledge were colonial scientists and educationists, colonial officials and missionaries, whose motives could have been quite diverse. The premises underlying this flow or transmission of scientific knowledge as part of the civilizing mission is captured in an osmotic metaphor according to which truth flows from regions of high to regions of low truth concentration or from regions of light to regions of darkness.[4] This effectively was translated into the nineteenth century context as a uni-directional flow from Europe to the non-West. An unstated assumption of the model was that while being transferred, knowledge was unattenuated, unchanged and uncontaminated, in other words translation was linear in two senses. In the first sense there was a transmission of ideas involving a physical translation from one region to another, and in the second sense this translation was premised on the possibility of finding equivalents of concepts and ideas from one language in another that would preserve meaning across the translation process itself. Naturally the history of science over the last thirty years has departed significantly from this naïve model. But as we know, naïve models are not so naïve and the most difficult to grow out of.

In the following pages I shall look at the process of institutional transfer of the system of higher education in India during the colonial regime (not at the transfer of scientific ideas) in order to accentuate that while scholarship is open to the idea that the transfer of institutions from one cultural context to another implies complex processes of cultural translation, the transfer of ideas and philosophies are not. On the contrary, it has been well established that there is a

3 HARDING, 1998; HABIB / RAINA, 2007.

4 SHAPIN, 1983.

co-evolution of institutional and epistemological change and that an institutional transformation is concurrent with an epistemological one.[5]

Modern institutions of higher education in India were shaped, over the last two centuries, by a multiplicity of forces and interests. Several historiographic frames have strung together narratives of the history of science education in general, and science education at the collegiate and university levels in particular. These accounts usually commence by pointing out the state of decline of indigenous science and technical education during a period of rapid social and political change in the early decades of the nineteenth century.[6] In India, the first modern universities were established in 1857 in the so-called "presidency towns" of Bombay, Madras, and Calcutta. A few more were subsequently established before the end of the century. These first generation universities were largely examining bodies that produced manpower for the efficient management of the empire. The different historiographic perspectives mentioned are woven together, on the one hand, either by the idea of modernization or the conception of globalization of science. Other frames include the idea of the civilizing mission or narratives of imperial history, both sharing a common ground of modernization as would several of the more liberal and nationalist historiographies of education under colonial rule. On the other hand, historians and sociologists of science committed to a conception of science as a cultural universal have seen science education itself as a vector for the globalization of science. Even so, both historians of science and historians of education, it could be ventured, more or less shared the same historiographical premises distributed across the positions just enumerated.

In this essay I would like to speak of the history of education in terms of the evolution of the institution for the production and reproduction of knowledge. In particular, I discuss the university as a place for teaching and conducting scientific research. On the one hand, over the last few decades the university has seemed to decline as the primary site for the production of knowledge. On the other hand, between 1820 and 1970, the university had become the primary site for producing and reproducing scientific knowledge. Consequently, there are those who would argue that the history of sciences during this period could just as well be subsumed under the history of education or the history of the university.

5 JASANOFF, 2004.

6 BABER, 1996: 137–138.

The evolution of higher education

Amongst the several frames available for studying the evolution of higher education in colonial India, the standard model speaks of a transplantation and cloning of British institutions and organizations, such as the university, on South Asian soil. The anti-colonial nationalist critique of the cultural imperialism of the colonizing power engages with the emergence of modern institutions of higher education against the backdrop of the erasure of pre-modern institutions. However, post-colonial theories depart from percolation models and rather portray a reality which perhaps far more implies the reinvention of modernity, and more recently, of multiple modernities.

The history of higher education entails the exploration of the varieties of universities, colleges and research institutions established in the equally diverse contexts of colonialism. Speaking of India, these institutional structures patterned on Western institutions were established during and after the period of colonial rule and were subsequently domesticated to the Indian environment.[7] First established in the early half of the nineteenth century, some of these modern institutions of higher education are probably the oldest institutions of the type in the Third World. The experience of combining scale with processes of domesticating the Western form of the university has provided many lessons and exemplars for Third World nations.[8] However, the popular idea that the Indian system of higher education is merely a clone of the British educational system existing during the period of colonial rule misses the process of the evolution of the university in India and the spirit of Eric Ashby's marvelous work. Ashby pointed out that the ontogeny of medieval higher education played itself out again and again, in other words that there was a structural replication of the process of domestication of the system of higher education. There were several stages in the ontogeny of higher education in the developing countries. For example:

- Students of a "developing country" travelled abroad due to the absence or scarcity of universities.
- This created pressure for indigenous education, resulting finally in the creation of a university as a "facsimile of some prototype".

7 ASHBY, 1966: 54–166.

8 ALTBACH, 1993.

- The university eventually contributed to society by ensuring that human affairs were administered by educated men.
- The new feature of this process of replication is that national forces played a very important role in adapting the university to national needs.[9] In other words, extending Ashby's argument, the cloned university is not isomorphic with the original but undergoes a process of differentiation.

In the early half of the nineteenth century the East India Company (EIC) was drawn into the debate of educating Indians. The questions considered important for educational policy at the time were:

- Should the East India Company encourage Western or oriental learning?
- Should English serve as the medium of instruction or was it to be a classical oriental language or the vernacular?
- Was mass education to be preferred to schooling for the elite?[10]
- What was to be the content of education and what pedagogy was best suited to the task?[11]

The question of pedagogy had not been resolved at the colonial metropolis. During the early decades of the nineteenth century, the Court of Directors of the East India Company wished to leave issues of content and pedagogy to be resolved at the local levels. The cautionary approach was adopted in order not to hurt the feelings of the local elites, who with the passage of time would be encouraged to join the new system of higher education and by the second half of the nineteenth century would comprise the first ranks of Indian engineers and doctors. However, the famous Macaulayan minute of 2nd February 1835 reduced these issues to a decision concerning "the medium of instruction to be adopted in higher education to be financed by the government".[12] The debate was closed by Bentinck, who was influenced by Benthamite and utilitarian ideas, by ruling that "the great object of the British Government in India was henceforth to be the promotion of European literature and science among the natives of India [...]. [A]ll the funds appropriated for the purpose of education would be employed on English education alone".[13] The project was motivated by the imperative of

9 ASHBY, 1966: 5.
10 BASU, 1981: 4.
11 KUMAR, 1995: 114.
12 BASU, 1981: 5.
13 BENTINCK quoted in BASU, 1981: 6.

governing and administering the British Empire in an efficient manner. Furthermore, a grave financial crisis at the time prompted Bentinck to employ Indian subordinates in the judicial and revenue services and hence to economize on the high pay of English officials. The recruitment of Indians into tasks performed by the company, it was felt, would not only improve the finances of the company, but also strengthen the commitment of Indians to British rule.[14] Thus different actors and agencies had different interests in the spread of Western school and higher education. The table below summarizes the interests of different actors:

Actors	*Motivations*
East India Company	Producing clerks and officials who could be employed cheaply.
Free traders	English educated Indians would develop English tastes and thereby create a market for English goods.
Missionaries	New education was the first step towards conversion to Christianity.
Liberals	The civilizing and human influence of Western learning.

According to Aparna Basu, the introduction of English education was a combination of "complex economic, administrative, political and religious motives".[15] The more important feature of this new impetus in education was that it was to be an experiment in the "secularization of education", which alongside with the formation of the first colleges, the establishment of universities later, and the development of curricula for an education program so conceived, had never been implemented in any of the colonies and possibly not even in the metropolis.[16] The university was to be a site for instruction in European knowledge which was to include the sciences. Nevertheless, a specific science and technology policy did not exist until the mid-nineteenth century or even later. On the contrary, it appears today that despite the commitment to some specific projects, the EIC and later the imperial government experimented with different institutional and organizational structures, in the absence of any template or exemplar that could have oriented their efforts.[17]

The notion of the colony as a social laboratory is an interesting one. The colony was a site where experimental tests were performed and results could later be exported to Britain or other parts of the empire. In a comparative con-

14 BASU, 1981: 6.
15 BASU, 1981: 7.
16 KUMAR, 1995: 115.
17 BABER, 1996: 186–187.

text, it was Roy Macleod who pointed out that British India, like Ireland, was amongst these social laboratories, and as far as India was concerned, the channel for the dissemination of Western science and technology were state sponsored institutions.[18] The origins of the idea of such experiments in social engineering could in part be traced back to Mill's *History of British India* which by the 1830s had become the standard manual for company officials who would be posted in India. Baber points out that while Mill[19] and Bentham were philosophical radicals opposed to colonialism, they did not see India as a colony in the way that Australia and Canada were. This was further reflected in the administrative division of labor in England, where the Colonial Office was separate from the India Office. In any case, Mill's *History of British India* was meant amongst other things to provide a theoretical foundation for liberating India from the fetters of its own culture. Drawing upon Majeed's work on Mill, Baber suggests that Mill's and Bentham's inability to test their ideas on "priest-ridden, lawyer-ridden, lord-ridden, squire-ridden, soldier-ridden" regions of Britain, reconceived India as the ideal testing ground for utilitarian theories. Both Bentinck and Macaulay[20] who subsequently shaped the terrain of education in India had received the imprimatur of Mill as much as they were inspired by him and his utilitarian colleague Bentham.[21]

Concerning the spread of universities, there have been four waves of intellectual colonization. The third wave of this colonization peaked in the middle of the nineteenth century when universities were first founded in non-Christian societies and in the process supplanted ancient indigenous centers of learning.[22] In the eighteenth century the deeply rooted indigenous systems of

18 MACLEOD, 1975.

19 James Mill (1773–1836) was a Scottish historian and economist, as well as was closely associated with the East India Company. His book *The History of British India* was successful and influential in shaping attitudes to colonialism. He was also the father of the liberal thinker J.S. Mill. One of Mill's contemporaries was Jeremy Bentham (1748–1832), who was a jurist and philosopher and the leading utilitarian thinker of his time.

20 Lord William Bentinck (1774–1834) was a British statesman who was Governor General of India from 1828 to 1835. Thomas Babington Macaulay (1800–1855) was an essayist, historian and served on the Superior Council of India from 1834–1838. The reforms suggested by him resulted in the promulgation of the English Education Act of 1835, that recommended the introduction of English as a medium of instruction in schools supported by the East India Company. Like Bentinck he was influenced by and close to Bentham and Mill.

21 See the section on Mill and the Utilitarians in BABER, 1996: 220–215.

22 ASHBY, 1966: 20.

education of the Hindus and Muslims were, according to one historiography, in a state of decline. Initially, the officials of the East India Company tended to support these systems under a modern format by founding the Calcutta Madrasah in 1781 and the Benaras Sanskrit College in 1792; other endeavors were initiated in Poona and elsewhere.[23] But later, this policy was challenged in England by evangelicals, liberals, and utilitarians.

A knowledge of "European literature and European science" was first imparted on the sub-continent at a college founded in 1817 called the Hindu College, and several decades later renamed Presidency College. This process of renaming signals the transition from a period of engagement with local knowledge forms to a period of the installation of a new imperial regime.

The scientific equipment for the laboratories was provided by the British India Society of London, and teachers of competence like Tytler and Ross became instructors. Courses on sciences were later introduced at the Calcutta Madrasa and the Sanskrit College and later in other cities such as Delhi, Banaras, Allahabad, Meerut and Patna.[24] In the wake of the formation of such colleges a multitude of scientific societies blossomed, dedicated to the translation of scientific material into the local idiom and thereby initiating the process of naturalization and domestication of modern science. By the middle decades of the nineteenth century, different parts of colonial India were witness to the assertion of science's cultural authority in a variety of forms. This variety was reflected in the plurality of organizations and societies founded often on a voluntarist basis, with little government support and patronage, dedicated to the creditable task of promoting science. According to Gyan Prakash, out of these organizations emerged a Western educated upper-caste, belonging to different regions of India and representing themselves as "[…] an Indian aristocracy of intelligence engaged in the liberal project of cultivating and spreading new forms of thinking and living".[25] By 1857 when the universities were established and superimposed upon these colleges, there were already 27 colleges across the cities of the South Asian region.[26] According to the Wood Dispatch of 1854 one of the objectives of instituting the new universities was to diffuse "[…] the improved arts, sciences, philosophy and literature of Europe […]. This knowledge will teach the natives

23 BASU, 1981: 1.
24 BASU, 1991: 126.
25 PRAKASH, 1999: 52.
26 BASU, 1991: 127.

of India the marvelous results of employment of capital and labor, [...] rouse them to emulate us in the development of the vast resources of this country".[27]

The educational agenda was gradually being tailored to the transmission of Western, or European, knowledge. This entailed the invention of strategies of localization and naturalization, and these varied across scientific disciplines and domains of written scholarship. Take, for example, the case of the introduction of English literature into India. A monetary commitment was made under the 1813 Charter Act enacted by the British Parliament delegating the East India Company to undertake the promotion of the sciences in India. This responsibility to the education of the native subjects had not even been made for its own British citizens.[28] As a discipline introduced in colleges and universities, the career of English literature commenced in the British colonies, and it was institutionalized far more rapidly as a discipline at the outposts of the Empire such as India and New Zealand than it was in England. English literature had entered Indian curricula by the 1820s. The pressure to reshape Indian education forced the colonial government to intervene and promulgate a policy of non-interference in religious matters of the local population. This gave cause for protests among the Christian missionaries who saw the broader goals of their mission as being advanced through the education of the local populations. If the missionaries were to be restrained from performing their activities, how would the colonial state continue to proceed with its civilizing mission? The productive resolution lay in the introduction of English literature as the bearer of the cultural values and superiority of the colonizing culture.

Two of the most visible objectives that underpinned the introduction of English literature was the need to impart knowledge of the mechanics of the English language, and to set new exemplars into circulation through an appropriate selection of literary texts in order to inculcate industriousness, trustworthiness and compliance among the native subjects.[29] In the missionary publications, English literature had been depicted as an exalted form of intellectual or cultural production. These were contrasted with the "scriptural" Oriental literature with its focus on divine authority. Access to Western literature was enabled through a new hermeneutic of reading that required the exercise of reason as opposed to faith. English literature as a discipline constantly portrayed the dis-

27 RICHEY, 1840–1857, part II: 364–93.

28 VISWANATHAN, 1990: 23.

29 VISWANATHAN, 1990.

tance separating the colonizer from the colonized and thereby de-naturalized itself from the source of its origin.

With the founding of the colonial state in 1857 most of the sub-continent came under direct British rule, while the remaining portion was referred to as indirectly administered India comprising the "native states".[30] However, it needs to be pointed out that modern institutions such as colleges and research institutes such as the Asiatic Society were established in India at least half a century before the formal inauguration of colonial rule by the East India Company.[31] The first universities established in India in 1857 were "examining universities" modeled on London University, that in turn became a "teaching university" in or around 1900. We shall not get into the question of why out of the five genres of British universities[32] only London University served as a model for export to India in the mid-nineteenth century. The university was a concretization of the ideas of utilitarianism that in turn was an important source of influence on the newly modernized Indian professional class.[33] While the first generation universities in India were founded in the nineteenth century under the rubric of nineteenth century utilitarianism, there arose the demand among Indians in the early twentieth century to transform the university into a teaching body and to extend its charter to that of a research institute as well. As happened in Europe, the "selective influence of national ideas"[34] resulted in the differentiation of universities in the twentieth century. At least as far as Europe was concerned, this crystallized into the creation of national academic styles and traditions of "national science".

Creating a new class

One of the many imperatives of colonial rule was to create a new class of Indians who would participate in the governance and administration of the empire. Imperatives such as these resulted in the creation of the first generation of modern universities in the presidency towns of Bombay (Mumbai), Calcutta (Kolkata) and Madras (Chennai)—all three celebrated their 150th founding

30 HETTNE, 1978.
31 BABER, 1996.
32 ASHBY, 1966: 22.
33 STOKES, 1959.
34 ASHBY, 1966: 7.

anniversary last year. These first generation universities were not teaching universities but examining bodies administered by educators from England, the focus of their teaching program being on the humanities. The Oxford model also inspired the formation of these universities in that they precluded an excessive emphasis on the sciences. The teachers were themselves graduates of Oxford and Cambridge and carried over the form of the education they had received, which meant an education in arts, not in sciences. In fact, it has been observed that the Syndicate of Calcutta University resolved to exclude instruction in geology from the academic curricula of the university in 1858.[35] As Ashby points out, the attractiveness of the London University model at the time derived from purely economic considerations. This tightfistedness rather than applying any overt policy of denying the Indians a proper science education prevailed for quite some time. The first three decades witnessed a sort of indecisiveness wherein science courses were sometimes introduced at some of the colleges and later withdrawn to be reintroduced within a short span of time.

One tends to think that the Asiatic Society of Bengal, which in the early decades of the nineteenth century was the "center of Western knowledge in India",[36] lost its importance to pronounce upon matters of education after the Anglicist-Orientalist controversy. At the heart of the controversy lay the issue of how scientific and technological education was to be imparted in the region. The Orientalists gestured towards existing systems of education that incorporated instruction in the sciences and proposed that it was possible to graft modern science onto a Sanskritic or Persian base. The Macaulayan minute and the Anglicists inspired by utilitarian philosophy differed and rejected the syncretic approach, suggesting instead the substitution of the traditional by the modern. From the beginning of the nineteenth century onwards, the East India Company acquired rights to collect revenue from a number of regions as a result of which they gradually withdrew support traditionally offered to indigenous education institutions like madrasas and patahshalas. Clearly, by the early decades of the nineteenth century, these so-called indigenous institutions were in decline with the disruption of the traditional patronage system.[37] Nevertheless, in 1868 the Asiatic Society petitioned the Viceroy on the dearth of human and financial

35 KUMAR, 1995: 115–116. Some of these decisions were prompted by the inability to find enough science teachers, either for lack of them or for lack of resources to appoint them, or provide adequate laboratory facilities at the non-governmental colleges as opposed to prestigious colleges like Presidency College, Calcutta.

36 PRAKASH, 1999: 52.

37 BABER, 1996: 187–190.

resources for instruction in the natural and physical sciences. The government's lack of will was chastened by an invocation of the recommendations of the British Association for the Advancement of Science (BAAS) and the increased urgency of the need to implement those recommendations in India.[38] By the 1870s, the ground began to shift, prompted by a number of factors including the role of enlightened individuals such as Richard Temple in Bombay Presidency. He was instrumental in ensuring that for the first time degrees in the sciences, in particular mathematics and natural philosophy, were awarded by the university from 1879 onwards.[39] Within a decade and a half, this program oriented towards the production of a new bureaucratic order gave cause for much resentment, and the newly educated class first began to plead that a scientific and technical education should be incorporated into the charter of the university. This plea gradually turned into a demand even while voluntarist associations such as the Indian Association for the Cultivation of Sciences (IACS) were founded to promote science education on national lines and under national management.[40] The scientific content of the program of this association were fundamentally inspired by the BAAS, which was working towards giving science in Britain more importance.

The colony was gradually transformed into a laboratory for scientific and technical experimentation and some of the early experiments on technical education had their first run within the colonies. Britain itself had few technical schools in the 1850s like the one in Glasgow.[41] But technical education was a pressing requirement for the efficient management of the empire. It was Lord Dalhousie who presided over the establishment of the Public Works Department (PWD) to accompany the plan to construct canals along the Gangetic plains, as well as to build roads from the then capital in Calcutta to the "newly acquired northern territories". A new regime of technology was introduced as part of the instrumentalization of the program of empire, which included both the expansion of the national telegraph system and the railway system. The technological imperatives stimulated a heavy demand for technical education and resulted in the establishment of the Roorkee Thomason College of Engineering in 1848.[42] The college was established to train professionals to develop and maintain civil works, bridges, and networks of irrigation.

38 KUMAR, 1995: 117.
39 KUMAR, 1995: 119.
40 RAINA / HABIB, 2004.
41 MACLEOD / DIONNE, 1979.
42 BASU, 1991: 128–129.

The College for Civil Engineering was established at Roorkee, India, in 1847, while the Imperial College, London, was founded in 1879. The shortfall of textbooks and teaching materials for engineering schools in England was initially met by periodically revised lecture notes, examples and drawings, and college manuals circulated amongst students at Roorkee.[43] These books codified Indian engineering practices and were "hailed as the most complete and satisfactory work on the subject in the English language".[44] While there was an immanent connection between instruction on science and technology in India and the emergence of the late colonial capitalist state, this required that the colonial state be innovative in the founding of formal technical institutions. Dionne and Macleod have established that these colleges founded in India served as models for replication in England in the late nineteenth century and that the colonial encounter contributed to the development of technical education in England and the state supported model of science.[45]

On the one hand, the trajectory of technical education was structured by the imperatives of colonial governance, while on the other hand the model of efficient governance required that the state play a proactive role in the construction of society, as was evident in the relation between the Public Works Departments and the first teaching universities of Calcutta, Bombay and Madras in the 1850s. The requirements of the PWD placed a constant demand on technical education and indirectly structured engineering courses throughout the nineteenth century. As a result, colleges were established in Poona in 1854 and a survey school in Madras was upgraded to an engineering college in 1859. It appears then that the 1850s were not only shaped by the systematization of the colonial regime but also by the systematization of the instruments of the colonial regime in order to augment the efficiency of the colonial state. The inauguration of the university system and the creation of colleges of engineering were part of this project of modernist rationalization.

The new urban intelligentsia produced by this system of higher education comprised administrators, civil servants, professionals, social and political leaders and reformers. They became vectors of the process of modernization.[46] By the early twentieth century and with the spread of university education, "higher education" itself came to be seen amongst colonial officials as the root cause of

43 MITAL, 1986: 17.
44 MITAL, 1986: 98.
45 MACLEOD / DIONNE, 1979.
46 BASU, 1981: 21.

politicization of the newly educated class and the spread of seditionary ideas and movements.[47] The dissatisfaction continued to mount from 1880 to 1910, the last decade being the most eventful politically. The mounting dissatisfaction amongst this newly educated class over the restricted career opportunities within the imperial dispensation and the experience of preferential treatment meted out on racial lines produced a variety of projects demanding greater self-sufficiency in scientific and technological research and training.[48]

One of the preoccupations of this class was to comprehend the cause of "Indian underdevelopment", in a sense a response to the cultural imperialism orchestrated through the colonial educational system.[49] The combination of this variety of circumstances crystallized in the rise of the nationalist movement. If the 1850s were significant because of the creation of institutions and structures for lodging the rudiments of a system of higher education and science teaching, the 1870s were important from another point of view. Within this emerging, Western-style educated class, the prestige associated with science began to seep deep into literary culture as well. Positivism had reached the shores of Bengal by the 1860s through the influence of the British positivists and the apostles of Congreve. Associations such as the Bengal Social Science Association founded in 1867 were instrumental not just as institutions that promoted research in natural and social sciences but advanced the cause of science as a ratifier of a new world order.[50] For this class both Mill and Comte were central intellectual inspirational thinkers, widely influential in validating the belief in scientific reason.[51]

Similar considerations resulted in a search for alternatives to the colonial policy of governing the empire which in turn would have to be provided by a different system of education. In the distressing years following the partition of Bengal, the National Educational movement inscribed within the National Council of Education would take off.[52] Part of this endeavor entailed a search for other university models. Increasingly, the idea of the teaching university and the Humboldtian idea of the teaching and research university gained wide currency. The movement for the establishment of what may be referred to as the second generation universities in India, those which departed from London University model, commenced in the second decade of the twentieth century. The idea of

47 BASU, 1981: 11.
48 BASU, 1981: 131.
49 KUMAR, 1995.
50 RAINA / HABIB, 2004.
51 PRAKASH, 1999: 57.
52 SARKAR, 1975.

having a system of higher education under a national management and on national lines was spreading. It is in this developmental context that the system of higher education was domesticated to the national context.

Two important outcomes of the struggle that was waged over several decades expressing dissatisfaction with the university system were the University Charter Act of 1904 permitting post-graduate teaching and research in the university, as a result of which Indian history and culture began to be reflected more visibly in the curricula, and that the demand for courses in science and engineering became more pressing.[53] But a M.Sc. degree was instituted as late as 1911.[54] The low level of enrollment in the science courses in the nineteenth century was frequently explained away by the colonial government on account of the reluctance of Indian students to soil their hands; when in fact several of the science courses were in fact too theoretical and thereby unpopular.[55] Perhaps the most important consideration that discouraged students from enrolling in science courses in the nineteenth century had to do with the limited opportunities for employment in the colonial government for Indians with degrees in the sciences—given that they were normally appointed to the subordinate services and provincial services.[56]

By the time the act of 1904 was passed, London University had itself changed and taken on teaching functions—so the introduction of teaching and research functions within the university were considered permissible. The clause permitting postgraduate teaching and research was not taken seriously by the colonial government; except for the Vice Chancellor of Calcutta University, Asutosh Mukherjee, who attempted to reorganize the university as a leading "teaching and research university". Drawing upon private philanthropy, the University College of Science was established in 1914.[57] Generous private donations enabled the setting up of laboratories and the creation of endowed professorships where the second generation of India's leading scientists would unfurl plans for the future of Indian science. The year 1914 soon became doubly important; in this year Indian scientists organized the first Indian Science Congress on their own. This itself was a premonition of things to come, for as Macleod argues, it carried an intimation of the possibility of Indian self-rule.

53 See the first two chapters of Section Two of RAINA / HABIB, 2004: 83–181.
54 BASU, 1991: 128.
55 BASU, 1991: 128.
56 BASU, 1991: 128.
57 BASU, 1991: 135.

In fact, several university models presented themselves in the first two decades of the twentieth century. One was the denominational university, by then perhaps an idea that was outdated even in Britain. The latter half of the nineteenth century witnessed the disruption of age-old coalitions between different religious and linguistic communities in South Asia, as linguistic and religious identities collapsed in parts of Northern India. Processes unleashed by modernization under colonial rule produced threat perceptions amongst Hindus and Muslims as each side saw the other capitalizing upon the benefits of the colonial state. Out of these threat perceptions emerged the movement for denominational colleges and universities devoted to the development of respective religious communities.[58] The idea was opposed as much by colonial officials as it was amongst sections of the modernized Indian educated class. These universities were nevertheless established and over the decades certainly played a role in providing a home for separatism as they did for creating a nationalist class. More importantly, Aligarh Muslim University and Benaras Hindu University developed good departments for the sciences and engineering over the years—in fact, even some of the leading scientists in post-independence India and Pakistan who would in the 1950s and 1960s don the mantle of leadership in their respective countries studied at these universities.

Transformation in the system of higher education

A number of factors went hand in hand to produce a transformation in the system of higher education towards the early decades of the twentieth century. The emergence of a large unemployed intellectual proletariat by the end of the nineteenth century had resulted in the rise of militant nationalism and in Calcutta combined with the reaction to the partition of Bengal that led to the creation of an alternative to Calcutta University. The alternative crystallized as Jadavpur University two decades later. Secondly, there was a demand for trained professionals from India's emerging industrial class, as well for the modernizing Indian state. Furthermore, the transition from the end of the nineteenth to the early decades of the twentieth century has been seen as one where the laissez-faire colonial state of the nineteenth century became an interventionist one that was responsible to its citizens.[59] This entailed that the state had to negotiate the

58 RENOLD, 2005; LELYVELD, 2003.

59 SARKAR, 1975; see section two of RAINA / HABIB, 2004: 81–181.

demands placed before it by its citizens, although they were colonial subjects. This was particularly the case in the realm of higher education.

The University Charter Act of 1904 legitimated scientific research activities of the university staff. Before the passing of the Act, such activities were carried out surreptitiously since they were not considered to be among the duties of the university staff. From an early state of blind admiration for this body called the university, a state of disenchantment emerged by the early decades of the twentieth century and found its expression in a new generation of universities founded only partially with government funding. The growth in higher education after the establishment of the first three universities in 1857 was steady but slow. With the transfer of education to limited Indian control between 1921 and 1947, the pace of growth of higher education picked up very rapidly, though the rate of growth was not uniform across the South Asian region, varying from region to region,[60] as well as between groups.

The second generation universities mushroomed throughout the country in the decades before the Second World War. These universities were residential and teaching and / or research universities established through private donations and grants from local rulers, landlords and industrialists. Often enough the states also contributed to these endeavors. On the one hand, the princely state of Mysore played an active role in establishing Mysore University; on the other hand a tripartite agreement was signed between the Maharajah of Mysore, the industrialist Jamsetji Tata, and the British Government of India to found the Indian Institute of Science again in the first decade of the twentieth century. This continued to remain one of India's premier research institutes in sciences and was inspired by the model of Johns Hopkins University in Baltimore. Similarly, in the domain of technical education during these very years, the idea was mooted that technical institutes modeled on the Massachusetts Institute of Technology were absolutely essential for the industrial development of the country. But the idea did not materialize until the early decades of the post-independence era, when the Sarkar commission decided to establish the five Indian Institutes of Technology.[61]

The idea of the "developmental state", propelled by a network of various scientific and technological institutions, more or less began to pick up with the establishing of the Indian Industrial Commission in the second decade of the twentieth century as questions of the state of industrialization became pressing.

60 BASU, 1981: 15.

61 BANGARU, 2004.

In fact some of the leading industrial houses such as that of Tata had entertained the idea of founding research institutes that would train the professionals for their industrial ventures. During the First World War there was a loosening of restrictions on the transfer of technology and a demand to set up research and development facilities in order to find substitutes for critical products and materials.[62]

In the 1930s, the National Planning Council was established to begin planning for India's scientific and industrial future envisaging the possibility that India would soon become independent of colonial rule. These deliberations from the 1930s and 40s prepared the ground for higher technical education and research for the period after the formal passing of colonialism. By this time, of course, scientific and technology related research was mostly pursued in disciplinary departments within universities. These departments were spread out across the first and second generation universities. At the time, it could be suggested that these departments existed at the universities in Calcutta, Bombay, Benaras, Aligarh, Mysore, Allahabad, and several others. Within these university departments there was a growing appreciation of the need to professionalize the still nebulous scientific research communities. Several leading Indian scientists of the time had either studied with physicists and chemists at Cambridge and other British and European universities or were connected to them through collegial ties of the discipline. These collegial ties, and their proximity to scientists of the Cambridge Left such as Bernal, Haldane, Blackett, and others, otherwise quite sympathetic with the Indian nationalist cause, ensured that the debates on science policy and planning were quite lively and germane to the developmental and political climate of the time.[63] In other words, Indian scientists located primarily and only in university departments were aware not only of the unwritten contract that science needed to work out with the state but equally during the war years and the rise of the phoenix of big science.

The rise of big science and mission-oriented research re-oriented the perspective of some of these scientists, some of whom had been decorated with the fellowship of societies and awards from the centers of scientific research, to reviewing whether the university should be considered the only centre for the production of scientific knowledge and technological know-how. This resulted in a situation where institutes pursuing research at the frontiers of science were veritably carved out of carefully groomed research departments in universities.

62 BASU, 1991.

63 ANDERSON, 1999.

As a result the research system differentiated into research institutes and universities.[64] During the post-independence period, some of these research institutes acquired the status of institutes of national importance, and their funding was separated from university funding. This differentiation resulted in an elite stratification of higher education and research, and was particularly evident in the world of science. The establishment and maintenance of these institutes was legitimated in terms of national sovereignty and self-reliance of the newly independent nation. In the climate it was felt that constructing systems from below was too time consuming and that leap-frogging in order to catch up with the developed world was the need of the hour. The elite structure of higher education offered a mechanism for ensuring that the independent nation did not lapse back into a state of neo-colonial dependency.[65]

This essay could have been entitled "Structure and Differentiation of the System of Science Education in Colonial India". But the larger point I wished argued is that the nineteenth century university was an institutional structure with new maps of knowledge that rendered the traditional institutions and maps irrelevant—as Sheldon Pollock, Sudipta Kaviraj and Chris Bayly have argued in the context of the Sanskrit ecumene in some recent work.[66] Yet, within the discourse of the university a number of other social and political discourses are visible that constantly reshaped the profile of the university and played an important role in reconstituting modern science. History of science, for long fixated on epistemology, has only recently begun to engage with the question of the reconstitution of modern science as it expanded into the colonies.[67] The history of the modern university in South Asia is an underdeveloped field and needs to engage with broader issues of the social history of knowledge and the processes by which different maps of knowledge were drawn up.

64 RAINA / JAIN, 1997.
65 RAINA / JAIN, 1997.
66 BAYLY, 1997; POLLOCK, 2001.
67 See the "Introduction" to HABIB / RAINA, 2007: XIII–XL.

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Biography

Dhruv Raina is Professor of History and Philosophy of Science and Education at Jawaharlal Nehru University, New Delhi. He studied physics at Indian Institute of Technology, Mumbai and received his Ph.D. in the philosophy of science from Göteborg University. His research has focused upon the politics and cultures of scientific knowledge in South Asia. He has co-edited *Situating the History of Science: Dialogues with Joseph Needham* (1999) and *Social History of Sciences in Colonial India* (2007), and more recently *Science between Europe and Asia* (2010). *Images and Contexts: The Historiography of Science and Modernity* (2003) was a collection of papers contextualizing science and its modernity in India. S. Irfan Habib and he co-authored *Domesticating Modern Science* (2004) which again addressed the encounter between modern science and the "traditional sciences" in colonial India. Over the last couple of years he has been working on cultures of history and science policy in postcolonial South Asia, in addition to a decade long preoccupation with the social theory of science, technology and mathematics. He has been a Fellow of the *Wissenschaftskolleg* zu Berlin, and later was the Heinrich Zimmer Professor for Philosophy and Intellectual History at Heidelberg University.