During his trip to Amir Abdurrahman’s court in Kabul in 1893 to negotiate the boundary that would bear his name in popular parlance, Henry Mortimer Durand spent much of his time worrying about maps. As far as the British were concerned, border delineation required maps, so Durand had in tow a number prepared by the Survey of India. Despite his faith in their accuracy, they proved insufficient for the delineation to be concluded. It turned out that the Amir also held maps in high regard – just not the ones that Durand brought to Kabul. Much to Durand’s frustration, Abdurrahman questioned the detail of British maps, insisting on the production of larger copies and demanding a bespoke rendering of the strip a few miles either side of the border that Durand proposed. After four officers in the British delegation rendered these maps, Durand began to feel that progress was being made on agreeing the border.¹ This proved premature, as the Amir began to engage in cartography of his own, ‘scoff[ing]’, Durand recalled, ‘at any maps not drawn by himself’.² There followed a prolonged debate over whose maps were more accurate. Durand acknowledged that Abdurrahman’s were occasionally ‘good’, but did some scoffing of his own in claiming that ‘when the Amir draws one utterly wrong it is hard work’ and describing the Survey of India’s image as ‘a real map’.³ Abdurrahman responded by invoking his experience in the field to query British representations: Durand recorded him saying, “That is no use – it is all wrong. I know – I have been to these places. Your maps are guess work.” He also suggested that colonial map-images were not as impartial as Durand said: “Whenever you are dealing with one of my alleged encroachments it [is] made very big on the map – When you are dealing with one of your own I notice it is quite a tiny little thing.”⁴ Although the Amir’s contestations did not shake Durand’s fundamental belief in the representations afforded by British surveying and cartographic techniques, they did force him to admit specific imperfections: ‘Chageh for instance is quite wrong in our

¹ MSS Eur D727/5: Durand to Lord Lansdowne, 24, 25, and 26 October 1893.
² MSS Eur D727/4: Durand to the Marquis of Dufferin, 27 November 1893.
³ MSS Eur D727/5: Durand to Lord Lansdowne, 3 November 1893.
⁴ Abdurrahman, quoted in ibid.
survey map. It is more than twice as far from the Helmund [River] as it ought to be. Following his conversations with Abdurrahman, Durand left Kabul with a sense that British maps of the frontier were imperfect, contestable, and certainly not iron foundations of colonial power.

Abdurrahman and Durand were not the first to call into question colonial frontier maps. Trudging ever deeper into the forested uplands to the east of Bengal in forlorn pursuit of an elusive enemy beyond the control of the British Indian state, members of the 1871 to 1872 Lushai Expeditionary Force pondered how to comprehend and convey their surroundings. In dispatches to the Indian Express newspaper of Calcutta, ‘Correspondents’ with each of the two military parties extolled the contribution to spatial knowledge made by trigonometrical survey detachments accompanying the Expedition. One attested that the surveyors had ‘further opened to the ken of Geography and British Indian progress, a not small region deemed an entangled and impenetrable jungle’. Some dispatches drew on the surveyors’ work in specifying latitude and longitude at the time of writing to the nearest second. Others supposed that previously published maps would be available to at least some readers, with one advising those ‘who [possess] the “Reconnaissance of the Lushai country,” Surveyor-General’s office, 1870’ to locate a topographic feature mentioned in the narrative ‘in the letter O in the title of the map, the words LUSHAI COUNTRY’.

But as the party travelled further from colonial territory and ennui set in in the face of fleeing communities and unfulfilled objectives, the spatial imaginary described to the readers of the Indian Express took on new qualities. Maps were invoked less frequently; the reader was instead called upon to reference a different repertoire of images including ‘Gustave Dore’s Flood in his illustrations of the Bible’, a romanticist rendering intended to evoke the extraordinary climatic conditions and perceptions of existential threat in these frontier environs: ‘[it] seemed as if we had but the mauvais quart d’heure between us and death’. Darkly comic references with more than a hint of self-lampooning also began to jostle with references to longitude and latitude in the effort to make sense of the Expedition’s environs for those back in urban Bengal.

It is a melancholy thing when one progresses, as it were, beyond all human ken – out of the sphere of sympathy; a Latitudinarian in fact. Yet so it is; we have arrived at No Man’s Land, and Laputa or Brobdingnag may at any time burst upon our view . . . I go to bed, in fact, every night, expecting in the morning to be greeted by the Great Panjandrum with

5 Ibid.
7 Ibid., f. 30: ‘From Our Correspondent with the Left Column’, Indian Observer, undated.
8 Ibid., f. 3: ‘From Our Correspondent with the Right Column’, 22 December 1871, Indian Observer, 6 January 1872.
the button on top, who shall announce our arrival in China. Eastward Ho! is the name of our novel adventure. By the last accurate accounts General Bourchier has marched clean out of the map, a military blunder which the Quarter Master General’s Department will find it hard to pardon.9

This dense intermingling of allusions to and puns on Christian theology, the novels of Jonathan Swift and Charles Kingsley, Samuel Foote’s satire, and colonial military-institutional politics poked fun at the limitations of existing map-images of the region and the fetishisation of accuracy. It conjured up a space defined by unreality, rendered more comprehensible by assimilation into fictional worlds than by global coordinates.

This version of the Lushai Hills was a ‘fabulous geography’.10 It was a product of what Johannes Fabian has described as agents of empire being ‘out of their minds’, unable and unwilling to purify their accounts of irrational, anarchic qualities.11 It directly contradicts the notion that high imperial surveyors and their multiple audiences imagined space as an idealised map, there to be dominated, with ‘nothing hidden or convoluted, no shadows, no “double entendre”’.12 As surveying extended further into colonial India’s frontiers in the later nineteenth century, British spatial imaginaries became not less but more convoluted, shadowy, and riven with double entendres. Maps, written narratives, and sketches often contained signs of equivocality. The often multiple or indeterminate authors of these representations failed or did not seek to eradicate their particular labours in constituting them. In addition, those involved in the production and reception of cartographic artefacts increasingly called them into question, suggesting they could not truly or comprehensively convey the spaces to which they pertained.

As the nineteenth century progressed, India’s frontiers became more intensively mapped. These regions also became increasingly significant as surveyors came to see them not as fragmented and distinct localities, but as part of a unified ‘Indian frontier’ that provided distinct challenges and opportunities for surveying and mapping. Beneath local specificities, three broad junctures of frontier surveying can be discerned. Sporadic military ventures into the ill-defined fringes of British power during wars and annexations from the 1820s to

12 Bruno Latour (referring to paper maps), cited approvingly in Edney, ‘Bringing’, p. 71. Edney develops this point to contend that maps ‘allowed Europeans to conceptualise the world and to think that they could dominate the world itself’ (p. 78).
the 1840s involved hasty route surveys – measurements of distance and bearing between places with occasional calculations of location by astronomical sightings. British and Indian agents continued to execute route surveys for various purposes long afterwards; but during the 1850s surveyors began to ‘fix’ topographical features in frontier regions by trigonometrical observations – the calculation of angles and distances in a series of connected optical observations starting from a physically measured ‘baseline’. As colonial state interference increased from the later 1860s, the era of distant sightings gradually gave way to the increasing presence of trigonometrical survey detachments among frontier uplands and deserts. One significant manifestation of this trend was the Survey of India’s advent of a ‘Superintendent of Frontier Surveys’, institutionalising a unified conception of the British Indian frontier stretching from the deserts abutting Persia in the west to the forested highlands of Upper Burma in the east via the high Himalaya.

Surveyors and men of science in colony and metropole widely deemed comprehending the mountains, deserts, and river courses that lay tantalisingly beyond the limits of governed British India to be one of the defining goals of imperial institutions and techniques of knowing space. This chapter shows how these areas were not only considered hinterlands of nearly unparalleled opportunity but also appeared to present challenges that struck at the heart of established means of fixing and rendering space. For many involved in gathering spatial knowledge, it was precisely these difficulties that valorised their efforts. British India’s frontiers served a vital role in countering increasingly common insinuations in the later nineteenth century that knowing space involved little more than the application of a standardised set of procedures, and that the era of heroic battles against nature had closed. Explorers and surveyors engaged at frontiers accordingly made sure to foreground their difficulties in a host of official, scientific, and popular accounts. However, the tensions between self-erasure and self-promotion were not always sustainable, nor were the struggles of knowing frontier space merely canny rhetorical ploys.

This chapter engages the recent work of some theorists and historians of cartography on the operative impact of maps and other spatial representations. One of the most fecund aspects of this strand of scholarship is the insistence that we should not assume that particular spatial representations were understood and used in homogeneous, stable ways. As one theoretical intervention puts it, ‘maps do not emerge in the same way for all individuals’. Moving away from J. B. Harley’s notion of maps as texts, which exaggerated the power of maps to create uniform realities, and towards maps as elements within

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broader assemblages that are performed in various ways leads to a focus on distribution and use. As in equivalent moves in literary theory and intellectual history, this shift involves heightened attention to diversity and scepticism towards the notion that a single representation or representative mode can have a uniform effect. In Michel de Certeau’s words, ‘a “polytheism” of scattered practices survives, dominated but not erased by the triumphal success of one of their number’. This chapter draws out fragmentary evidence of frontier map usage, showing that agents of imperial surveying widely understood maps and narratives of frontier spaces to be fragile communicative devices prone to unstable reception.

It also contends that spatial representations were not only disrupted by processes of collation, production, and reception beyond ‘the field’ but were equivocal all the way back to initial acts of information gathering. Knowledge of frontier spaces was composed of processes in which ‘the actors were trembling’. Moreover, these actors tended to emphasise that they were not only trembling (literally in some cases) but also laughing and being laughed at, stumbling, and dying. Admissions of fallibility were not merely about meeting popular demand for tales of danger. They appeared with surprising consistency across written and visual genres, forming part of private correspondence within the survey establishment as well as mass-market accounts. These crises also had epistemological effects that were not necessarily overcome through the use of ‘reason’ or in ‘centres of calculation’. Surveyors did not assume the existence of an authoritative epistemological domain sealed from a shifting array of challenges to stable knowledge experienced ‘in the field’. The persistent presence of particular circumstances in published representations of frontier India suggests that the ‘tension between the local view and the broader overview’ identified by D. Graham Burnett and others in Britain’s American


16 de Certeau, Practice, p. 48, emphasis in original.

17 Bruno Latour, We Have Never, p. 126.

colonies was a widespread and long-lasting element of spatial knowledge production in the British Empire.\textsuperscript{19}

The chapter both develops and departs from Matthew Edney’s much-cited assessment of cartography in India during the earlier colonial period.\textsuperscript{20} It takes a lead from Edney’s concept of ‘cartographic anarchy’, which brilliantly describes the chaos and heterogeneity of survey work on the ground in British India.\textsuperscript{21} However, it dissents from his notion that surveyors and map-makers ‘cloaked’ these circumstances to a degree that enabled them to believe that ‘the cartographic archive and its constituent surveys was indeed a perfect geographical panopticon’.\textsuperscript{22} The agents examined in this chapter did not consider maps or any other representative form in such strident terms. They instead diagnosed, bemoaned, and theorised those ‘anarchic’ processes that Edney claims to have exhumed from a deep grave of colonial erasure and elision. Colonial surveyors were reflexive and anxious about spatial knowledge in multiple ways over the later nineteenth century, engaging just as much as recent scholars in critical assessments of cartography.

These core contentions develop through the five sections that form the rest of this chapter. Broadly chronological, each section also addresses distinct elements and junctures within the broad project of knowing the frontier spaces of colonial India. The first section looks at route surveys at the expanding, shifting fringes of colonial India undertaken up until the 1840s. It argues that while route surveys complemented the logic of British governmental expansion and annexation, they were also diverse and fraught undertakings composed of numerous, often controversial, techniques. Far from being expression of unitary state power, the production and reception of data garnered by these surveys were contingent on a host of local variables. The next section closely examines the activities, actors, and instruments that constituted survey data during the mid-nineteenth-century period when trigonometrical surveyors viewed prominent features of frontiers from a distance. It shows how the challenges of accurate altitude measurement, deemed an essential feature of effective triangulation, led these men not only to undertake a host of much celebrated


\textsuperscript{20} Edney, Mapping; Bernardo Michael also shows the widespread nature of practical difficulties in British surveys in India, but, like Edney, suggests that these challenges were largely occluded in and overcome by the map-image. See Bernardo A. Michael, ‘Making Territory Visible: The Revenue Surveys of Colonial South Asia’, Imago Mundi, 59, 1 (2007), pp. 78–95, here pp. 89–91; Bernardo A. Michael, Statemaking and Territory in South Asia: Lessons from the Anglo-Gorkha War (1814–1816) (London: Anthem Press, 2012), Ch. 6.

\textsuperscript{21} Edney, Mapping, p. 29; Ch. 5.

\textsuperscript{22} Ibid., p. 34. See also Edney’s claim that ‘[t]he texts and maps did not present truth, nor do the maps constitute panopticons. The British simply believed that they did’ (p. 26).
improvisations but also, contrastingly, to begin to perceive that even perfectly processed survey data could never represent territory with full accuracy. This was a key moment in which doubts about an irreducible limitation in the project of knowing territory started to fester, setting the scene for later shifts in attitudes towards depicting and experiencing space among surveyors at colonial India’s frontiers.

Before addressing this later period, the third section focuses on widespread debates among members of the British Indian survey establishment about frontier maps as material objects. Surveyors and users alike were not fixated solely on ideals of accurate data but also sharply aware of the challenges of making and distributing useful images of frontier environs. The advent of surveys of these areas from the 1850s was a key driver of technological shifts in map production and dissemination in colonial India. These were processes entailing multiple concerns as well as apparent triumphs, with flows of geographical information often far from consistent or well directed. The following section takes this story of anxieties about representation back to the field, looking at the period from the 1860s when surveyors ventured into frontier regions rather than gazing at them from distant vantage points. It shows how surveying frontiers came to assume huge significance for colonial agents but was simultaneously beset with multiple difficulties that frequently appeared to constitute insurmountable barriers to gathering effective data. These concerns went beyond those of earlier decades in being seen as unresolvable through the use of reason or by further survey work.

The final section of the chapter demonstrates how trends established over previous decades reached a peculiar resolution during the closing decades of the nineteenth century. Impediments to comprehending frontier spaces combined with cultures of romanticism, mysticism, and anti-empiricism to undergird widely held ideas among surveyors and men of science that these regions were somehow elusive, maintaining a margin of unknowability beyond even the calculations of trigonometrical surveying and the planar projections of map-images. Many agents of empire came to understand frontiers in ways that foregrounded the bodily over the cerebral, the immersed experience over the removed gaze, and the playful over the serious.23 They operated within and contributed to spatial imaginaries that involved heterogeneous modes of understanding and communicating, and which doubted the value of ‘scientific’ surveying even as they undertook it. Crucially, unlike conceptions among colonial agents of the earlier nineteenth century of ‘jungle’ and upland areas

as regions of disorder but also of potential reform, India’s high imperial frontier
deserts and mountains came to be understood as permanently resistant to ‘improvement’.

Developing this contention of the distinctive nature of late nineteenth-century surveyors and explorers’ understandings of frontier space, the chapter concludes by suggesting that knowing frontiers took on forms that incorporated but ultimately exceeded well-developed notions of ‘the sublime’. These forms of knowledge, I suggest, can usefully be understood through Martin Heidegger’s conception of the ‘world-picture’. Recent scholars of imperial representation have employed this theory but have not made use of its core tension. Timothy Mitchell and Derek Gregory, for instance, claim that European empires ‘enframed’ their colonised territories and communities as ‘objects to be viewed’, separated absolutely from the viewing subject of the coloniser. They overlook Heidegger’s contention that the ‘unlimited power for the calculating, planning and moulding of all things’ in the ‘modern age’ produces a sort of surplus – which Heidegger terms ‘the gigantic’ – which ‘becomes . . . incalculable’. Many of the late nineteenth-century actors engaged in producing knowledge of India’s frontiers construed them in ways akin to Heidegger’s ‘gigantic’: shadowy arenas ‘withdrawn from representation’ in which to challenge and to lose oneself at a time when technologies of triangulation had apparently fixed the imperial Subcontinent.

2.1 ‘Getting at the Truth’: Route Surveys at Nascent Frontiers

While personnel of the Great Trigonometrical Survey (GTS) laboured over the ‘Great Arc’ from southern tip of peninsula India to the Himalayan foothills, into the 1840s terrain around and beyond the hazy limits of colonial government continued to be known solely through more rudimentary methods. Extant texts and maps were scoured and local people and travellers were interrogated. When and where it seemed possible and practical – or, sometimes, sufficiently improbable and impractical for someone to be allured by the potential acclaim – British agents of empire undertook route surveys. While they often shared trigonometrical surveys’ aspiration to represent terrestrial space in three dimensions, route surveys could dispense with all but a single dimension: that of the line of a path from one place to another. Altitude measurements

and lateral sightings were optional and frequently proved erratic or impossible. In its most sophisticated form, route surveying involved arrays of adapted instruments, fastidious practices of observing features either side of the primary path, and intersecting points and closed circuits that allowed for checks against errors. At its most rudimentary, it merely produced an itinerary – a list of place names, which, as Catherine Delano-Smith shows, was the only means of long-distance wayfinding in most cultures until at least the nineteenth century.28

Route surveys around and beyond the limits of governed British India until the mid-nineteenth century were diverse in motive, method, and impact. Various military and civil officials along with travellers with different degrees of connection to colonial administrative bodies garnered arrays of spatial and ethnographic knowledge.29 There was little by way of central coordination or standardisation before, during, or after these surveys. The earliest forays beyond the colonial state’s limits tended not to become fixed reference points for subsequent surveyors and were liable to be denigrated as much as admired.30 During the brief British military foray into Assam from 1792 to 1794, an officer named Wood collected some geographical information and produced a map. His successors during the colonial invasion of the region in the 1820s did not, however, use his work as a basis for their own. Richard Wilcox, whose surveys of the 1820s will be considered shortly, disparaged the limitation of Wood’s survey to the banks of the Brahmaputra River, stating that the spaces beyond remained ‘a perfect blank’. 31 George Forster’s data on the routes beyond the northwestern limits of the colonial state’s territory, gathered during his famed overland ‘journey from Bengal to England’ in the 1780s, were similarly doubted rather than acclaimed by later surveyors of the region.32 Mountstuart Elphinstone noted in the influential account of his ‘embassy’ to the areas around Peshawar in 1808 that, unlike Elphinstone’s colleagues, Forster had no instruments and relied on local information for distances. Forster ‘could not’, Elphinstone pronounced, ‘be so good a judge of the length of a stage as a person who had often travelled it, and was besides accustomed to estimate the rate at which camels move’. 33 Unlike Wood’s survey data, which did not even

29 This was also the case throughout the rest of colonial India: see Edney, Mapping, p. 162.
30 On admiration of earlier travellers and rhetorical strategies among later explorers to position themselves in relation to predecessors, see Burnett, Masters, pp. 37–9.
31 R. Wilcox, ‘Memoir of a Survey of Assam and the Neighbouring Countries, Executed in 1825–6-7-8’, Asiatic Researches, 17 (1832), pp. 314–469; here footnote p. 316. See also Simpson, ‘Forgetting’.
32 G. Forster, A Journey from Bengal to England (Calcutta, 1790).
feature in collections of maps assembled for military use during the Anglo-Burmese War during the 1820s,\textsuperscript{34} Forster was among the sources for at least one Company-State map of the region beyond its northwestern limits during the First Anglo-Afghan War.\textsuperscript{35} This longevity, however, spoke less of confidence in his veracity than the paucity of subsequent information gathering.

The compilation of multiple surveys into regional maps indicates one aspect of the potential for route surveys to transcend the narrow limits of the linear path of a single surveyor. Especially before the advent in the second half of the nineteenth century of widely circulated guides to route surveying such as the Royal Geographical Society’s (RGS) \textit{Hints to Travellers},\textsuperscript{36} compilation was fraught with difficulties. It entailed not so much the smooth integration of homogeneous material than the messy melding of diverse ways of seeing and recording.\textsuperscript{37} One notable feature of the use of route survey data in later maps of India’s nascent frontiers was the tendency not to erase fragments that clearly bore marks of a particular time and place. For instance, a map of ‘The North-Eastern Frontier with Burma and part of China’ published by the Survey of India in 1862 retained (but mangled) a note lifted from Wilcox’s survey narrative: ‘On the 24\textsuperscript{th} May 1827 when the Snow was fast melting on the mountains at its source, the Namyen River was here but 80 yards broad and fordable & was fordable \textit{[sic].}’.\textsuperscript{38} Rather than presenting an authoritative, fixed view of regional space in which the moment and location of fieldwork were removed, frontier maps based on route surveys tended to retain signs of these specifics.

The circumstances of route surveying were, above all, highly varied. Many surveys were the work of solo travellers, and many more that relied on supporting retinues were described as if they were lone ventures. These surveys, unlike trigonometrical counterparts, were in word if not in deed ‘solitary and nomadic affairs’, as D. Graham Burnett puts it in his work on British exploration in South America.\textsuperscript{39} While route surveying generally meant an individual human operating in the landscape, in other respects surveyors were required to make clear that they were far from alone. In particular, instruments mattered. During the nineteenth century, barometers and boiling point thermometers (for measuring

\textsuperscript{34} IOR/H/678.
\textsuperscript{35} BL, IOR/X/1620: ‘Map of Countries on the North West Frontier of India Compiled from Various Documents. By John Walker Geographer to the Honble. East India Company’.
\textsuperscript{37} For example, Elphinstone, \textit{Account}, 3rd ed. xxxix–xlii.
\textsuperscript{38} NAI Cartographic, Survey of India, F.98/24–25. \textsuperscript{39} Burnett, \textit{Masters}, p. 10.
altitude), perambulators (for measuring distance), sextants and theodolites (for taking bearings), and notebooks (for recording data) were increasingly taken as markers of credibility. As recent work has amply demonstrated, however, instruments were fragile and unreliable, requiring not only material upkeep and modifications but also ‘rhetorical repair’ to ensure that they established the authority of the person who wielded them and of the data they supplied.

The ‘states of disrepair’ of various instruments was a repeated theme in route surveys beyond the established bounds of colonial India and took various forms. Sometimes, instruments were unavailable – a cause not just for concern but also for celebrating the surveyor who sought to overcome this limitation. For instance, Wilcox applauded the work of his colleague Burlton in surveying the eastern portion of Upper Assam in the 1820s ‘with a surveying compass only, and unfurnished with any instrument for measuring distances’. The scarcity of instruments and criticisms of their quality was a common refrain. It was evident especially among military officers who, without formal coordination, executed route surveys around and beyond the fringes of Sind during the First Anglo-Afghan War. The Bombay Government received a slew of requests for surveying instruments from its agents in Sind and repeatedly failed to meet this demand. Asked by John Jacob, the Assistant Political Agent in Upper Sind for ‘six (6) glass Barometer tubes which will be very useful to me occasionally in measuring the heights of different places’, the authorities sent four, ‘no more . . . being in store’. Nor could they find ‘a good surveying compass’ that one officer requested to enable him to render ‘a rough sketch’ of ‘parts of the country hitherto unknown’.


44 MSA, Political, 1841–42, Vol. 79: John Jacob, Assistant Political Agent, Upper Sind, to James Outram, Political Agent, Sind, 25 November 1841; J. Dickenson, Chief Engineer, Bombay, to G. M. Anderson, Governor of Bombay, 24 December 1841.

Even when the beleaguered Bombay Government managed to dispatch the required hardware, instrumental woes continued. Senior officials felt that using instruments was ‘likely to alarm and excite [Baloch] prejudices’. The first British surveyor of the portion of Sind adjacent to tribal areas accordingly employed only ‘a pocket compass and the occasional use of a sextant’. Furthermore, this surveyor reported that the sextant had ‘some imperfection’ that meant that he ‘cannot depend upon’ the latitude measurements it produced.\textsuperscript{46} As was later the case in British surveys in the Arabian peninsula during the 1850s and 1860s,\textsuperscript{47} in Sind during the 1840s ‘distances were determined by the rate of a camel’s pace both ambling and walking’ rather than by the perambulators that the surveyor had requested.\textsuperscript{48} Some complaints about surveying instruments took a more furious tone. One officer vented angrily in the official report on a route to Kalat that:

Unfortunately the surveying instruments with which I was supplied are so extremely bad that my labour has been inconceivably increased & since the hour I left Kilat [sic] the mapping down of my daily outdoor work (rendered extremely intricate by the innumerable observations I have been compelled to take) has so entirely consumed my time and occupied my attention that I have been utterly unable to make enquiries on many points of interest.\textsuperscript{49}

Despite his intemperate outburst, within a month this officer found himself in charge of the Sind Survey, after his superior resigned owing to the backlog of work that resulted from the death and ill health of the Indian draftsmen who rendered survey data in map form (e.g., Figure 2.1), and ‘the difficulty if not impossibility’ of securing adequate replacements.\textsuperscript{50} Route surveying at the outskirts of Sind in the 1840s was shot through with problems of instrumentation and expert labour at a time when effective data on and representations of frontier routes was a major priority for colonial forces engaged in Afghanistan and in Sind.

At least surveyors in Sind found one element to be more compliant than they had feared: the landscape. Unlike their successors in the later nineteenth century, who, as discussed later, found the desert terrain and climate wreaked havoc with optical measurements, the first British surveyor into Balochistan reported that ‘obstacles . . . were fewer, and of a character less formidable, than we had been led to expect’.\textsuperscript{51} The situation that confronted surveyors at the fringes of Assam during and following the war with Burma in the 1820s was

\textsuperscript{46} MSA Political, 1840–42: Sinde: G. LeMessurier, Assistant Quarter-Master General, to Outram, 4 March 1840.
\textsuperscript{48} MSA Political, 1840–42: Sinde: LeMessurier to Outram, 4 March 1840, 29 June 1840.
\textsuperscript{49} MSA, Political, 1841–42, Vol. 79: Robertson, undated attachment to LeMessurier to Government of India, 29 December 1841.
\textsuperscript{50} MSA, Political, 1841–42, Vol. 79: LeMessurier to Bombay Government, 19 January 1842.
\textsuperscript{51} MSA Political, 1840–42: Sinde: LeMessurier to Outram, 19 November 1841.
very different in this respect. Once colonial forces invaded Assam in 1824, intensive survey operations were an immediate priority. Surveyors travelled throughout the Brahmaputra Valley and into the hills beyond, including to areas at the northeastern fringes that were not visited again by British personnel until the last decades of the nineteenth century. They accumulated topographical data not only for strategic military purposes, as was the case in the 1840s in Sind. In addition, they aimed to resolve a ‘mystery’ much debated among leading European men of geography, including the Surveyor-General of India, John Hodgson: whether the Tsangpo river of Tibet became the Brahmaputra River in Assam or the Irrawaddy River in Burma. The data they generated fed into substantial regional maps, most notably one compiled by Wilcox that covered Assam, the uplands north of Burma, eastern Tibet, and part of the Yunnan region of China (Figure 2.2).

Figure 2.1 Thomas Postans, untitled map of Upper Sind Frontier (1841)\textsuperscript{52}

\textsuperscript{52} MSA Political, 1841–42, Vol. 75: Postans to Outram, 24 May 1841.
Figure 2.2 Richard Wilcox, ‘Map of the countries lying between the 20½ & 30 of N Lat. & 90½ & 99 E. Longitude’, in *Asiatic Researches* (1832). Reproduced by kind permission of the Syndics of Cambridge University Library.\(^5\)

Yet route surveys in the densely forested riverine plains and labyrinthine hills in and around Assam proved difficult and were limited in scope and credibility for various reasons. Like the British explorers of the African interior in the mid-nineteenth century, surveyors in this region privileged ‘ocular demonstration’ – that is, seeing with their own eyes. Yet, just as in Africa and other locales across the globe, there were multiple obstacles to clear vision. Wilcox’s ‘Memoir’ of his route surveys in the region, published in *Asiatic Researches* in 1832, repeatedly cited the landscape and climate as significant impediments. Approaching one summit in the hills beyond the extreme north-east of the Assam Valley, Wilcox recorded:

> It may be supposed what interest was excited as each new gain on the mountain’s steep face brought me nearer to that height whence I expected to overlook the unknown regions through which the Brahmaputra has its hidden course, but I suffered disappointment. Another mountain rose close to this one on its east, and where the capricious clouds permitted, through their casual openings, a passing glimpse of the rugged country beyond, all I could perceive was fir-clad mountain or a patch of snow.

This was far from an isolated occurrence. Wilcox even assigned some blame to the course of the Brahmaputra – the very thing that his surveys promised to establish – writing that ‘its crookedness limited the view and closed it abruptly’. Meanwhile, at the Assam Valley’s southern fringes, impassable rapids twice prevented British surveyors in the 1820s from accessing the hills.

These difficulties of terrain made Wilcox and his colleagues unusually dependent on informants among communities in Assam and the surrounding hills, especially those who travelled through the hills for trade or religious purposes. Contrary to Matthew Edney’s suggestion that ‘local informants’ were routinely ‘glossed over and submerged’ in geographical narratives of this period, Wilcox’s ‘Memoir’ indicated his reliance on, and simultaneous scepticism towards, Asian travellers. His large regional map acknowledged not only European sources but also members of the Singpho community for the hills at

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56 Ibid., p. 380.
57 Ibid., p. 367.
the eastern end of the Brahmaputra Valley, Tibetan ‘Lamas’ cited in the French geographer d’Anville’s mid-eighteenth century Atlas, and, for information on Bhutan, ‘a Persian sent by Mr. Scott [the Governor-General’s Agent in Assam]’.\(^{\text{61}}\) In his written narrative, however, Wilcox repeatedly bemoaned irreconcilable or suspect data, especially on the Tsangpo’s route. As ‘ocular demonstration’ proved beyond him, Wilcox sought out information from ‘Lamas’ – here meaning Tibetans residing in the uplands northeast of Assam – who ‘must know, beyond all doubt, whether their territory is or is not separated from Thibet by a large river’.\(^{\text{62}}\) However, an attack on the survey party by members of the Mishmi community that interposed between the Assam Valley and Wilcox’s hypothesised ‘Lamas’ meant that he never reached them.

Other informants on the question of the Brahmaputra’s course appeared in Wilcox’s ‘Memoir’ only to be denigrated. The sacred geography within which Assam’s Hindu elites located the source of the Brahmaputra particularly vexed Wilcox. ‘The Asamese’, he wrote, ‘universally declare [the source] to be utterly inaccessible to man . . . At present there appear so many discrepancies between the Hindu legends, and facts, that we are quite at a loss’.\(^{\text{63}}\) Wilcox’s irritation towards inhabitants of the area he surveyed was limited neither to lowland communities nor to the provision of topographical information. He also castigated the indolence of his guides, reporting that they ‘could not conceive that any motive need occasion haste’.\(^{\text{64}}\) In one case, however, he forewent such a racialised attack in order to emphasise his own heroism. Reporting that his ‘Woollaston’s thermometric barometer’ had been ‘deranged’ by being inverted by ‘the man whose business it was to carry it’, Wilcox wrote: ‘nor can this be wondered at, seeing that all a man’s care was employed in preserving his own limbs from injury by a fall from the rugged precipices we occasionally clambered over’.\(^{\text{65}}\) Here is one instance of competing rhetorical impulses shaping descriptions in letters and published accounts that were crucial outputs of route surveys.

Obtaining geographical information on the regions at the outskirts of expanding colonial influence during the earlier nineteenth century was a fraught business. The production of data through undertakings both in the field and at the writing desk was diverse and frequently judged inadequate, as admonishing missives from superiors and ongoing controversies among audiences indicated.\(^{\text{66}}\) For instance, Wilcox’s efforts did not stably resolve the riddle of riverine routes in the uplands around Assam, northern Burma, and Tibet, instead merely strengthening the convictions of those, including

\(^{\text{65}}\) Ibid., p. 365.  
\(^{\text{66}}\) On efforts to systematise surveys and geographical knowledge gathering, see Kennedy, Last Blank Spaces, pp. 46–59; Driver, Geography Militant, pp. 49–66.
members of the British Indian survey establishment, who were already convinced that the Tsangpo joined the Brahmaputra rather than Burma’s Irrawaddy.\textsuperscript{67} There was no universally agreed measure of the validity of survey data or of what constituted topographical precision, even between the various institutions of the colonial state.\textsuperscript{68} The Military Department, for example, was generally content with plans of routes between strategic locales; by contrast, Presidency Governments and scientific institutions in colony and metropole alike increasingly sought area coverage.\textsuperscript{69}

The heterogeneous ways in which route survey data were produced and received were both products of, and contributors to, the indeterminacy of colonial India’s morphing fringes during the first half of the nineteenth century. As D. Graham Burnett and Daniel Foliard have shown in the cases of British Guiana and Arabia, respectively, ‘mobile and exploratory’ route surveying fosters a view of ‘expandable’ rather than fixed imperial space.\textsuperscript{70} As such, this form of surveying was a significant aspect of an era in which colonial frontiers in northeast and northwest India were not bounded by even a pretense of precision linear boundaries. As will be discussed later in this chapter, trigonometrical surveying did not straightforwardly supersede route surveying at and beyond British India’s frontiers. In some cases, atmospheric circumstances rendered long-distance trigonometrical sightings impossible, reducing surveyors’ fields of vision to narrow routes. And deliberate route surveys continued to be vital but precarious and disputable elements of spatial knowledge in the later nineteenth century, especially useful in the fractured terrain and politically fractious environs beyond the fully governed colonial state territory. As in the famous ‘transfrontier’ explorations into Central Asia undertaken by colonial-trained local personnel known as ‘pandits’, such surveys remained bound up with expansive definitions of colonial interests beyond sovereign state space.\textsuperscript{71} While they were a key element in the projection of colonial activity beyond already established territorial limits, this section has shown that route surveys and the maps that (sometimes) resulted were not

\textsuperscript{67} Simpson, ‘Forgotten’.


\textsuperscript{69} See, for example, debates over maps of the Sind frontier in the early 1840s: MSA Political, 1840, Vol. 95: Government of India to Bombay Government, 22 June 1840, f. 432; MSA Political, 1844, Vol. 95: Quarter-Master General to Government of India, Political Department, 7 September 1844.

\textsuperscript{70} Quotation from Burnett, \textit{Masters}, p. 10; Foliard, \textit{Dislocating}, pp. 31–41.

expressions of a stable and unitary project of colonial power/knowledge. Beset with difficulties in the field, which were only occasionally overcome through forms of ‘rhetorical repair’, route surveys at the limits of British political control were a diverse set of undertakings, and the circulation of resulting maps was limited. As the remainder of the chapter shows, trigonometrical surveying at India’s frontiers held out new promise for generating authoritative data for the colonial state but continued to be afflicted by a range of problems, old and new.

2.2 ‘Impossible to Level’: Frontiers and the Problem of Altitude in the 1850s

According to those who planned and executed it, the run of triangles extended during the 1850s from a coastal base-line at Karachi to the Attok River at the northern limits of recently annexed Punjab fully deserved the appellation ‘Great’, which was applied to only a select few trigonometrical series. From the outset, however, the Great Indus Series was riddled with difficulties that had palpable effects on its final form. In his initial instructions to the lead surveyor, Surveyor-General Andrew Waugh classified the undertaking as ‘essentially a frontier series’, and accordingly told him to route the survey ‘as near the boundary as political circumstances will admit or physical circumstances render desirable’. Waugh’s reiteration of this point – ‘keep as near the western frontier as practicable’ – amounted to little in the field. Broken terrain and lurid imaginings of tribal violence pushed the line of survey further east, well into colonial territory. In the first season he took the field, the lead surveyor of the southern portion of the Series had a host of complaints: the difficulty of ascending hills, lack of water, severe storms and torrential rain, freezing temperatures, dilapidation to previously built observation towers, and inadequate puckals (water carriers). An attack by local inhabitants on a trigonometrical station, which destroyed one heliotrope and damaged another, capped this succession of problems, prompting the lead surveyor to state plainly that ‘the series should never have approached so near the frontier’. He abandoned the originally agreed route along the hills that formed the designated boundary of colonial sovereignty in Sind, shifting the series further east – and thereby further from its original designation as a frontier series.

Relocating the Great Indus Series from the hills to the plains may have mitigated the anxieties related to ‘political circumstances’, but the terrain generated a new array of concerns. Substantially adapted instruments and surveying methods were put to work to surmount these challenges, with varied

perceived success. Their shortcomings were not limited to the realm of temporary aberrations but were understood by leading surveyors to have profound epistemological implications for the possibility of accurate spatial knowledge. Along with the difficulties of limited resources, competing calls on survey parties’ time and personnel, and damaged equipment that were part and parcel of what Edney terms the ‘cartographic anarchy’ of trigonometrical surveying throughout colonial India, the length of the Great Indus Series and the environs through which it was routed generated specific concerns. The components of ‘cartographic anarchy’ could in theory be overcome: instruments repaired, resources allocated, terrain covered at a later stage. But as GTS parties made their way across the plains of western Punjab and narrated their difficulties, senior survey officials came to perceive an apparently irreducible void between the territory and their representation of it. This was a moment of realisation for those at the apex of the colonial surveying establishment that the map – and even the raw observational data that undergirded map-images – was not, nor could ever aspire to be, the territory.

What precipitated this realisation, and why did it happen during the Great Indus Series rather than in another place, at another time? The surveyors engaged in the field during the mid- to late 1850s wrote mostly of quotidian problems and of overcoming them. They repeatedly discussed their apprehension towards using the ‘great theodolite’ (a 34-inch theodolite manufactured by Troughton & Simms that reached India in 1830), deemed ‘too valuable to risk’ in case of attack by frontier communities, especially when armed guards were unavailable during the Indian Rebellion of 1857 to 1858. The difficulty of obtaining labour to construct towers from which to make observations in flatter terrain was another recurring theme in their reports. But these were surmountable difficulties, causing postponements and in some instances requiring resurveys with the larger theodolite, rather than terminally compromising the accuracy of the work. A knottier issue emerged in the correspondence between John Walker, a lead surveyor on the Series and later Surveyor-General, and Andrew Waugh. The problem concerned ‘levelling’, the measurement of vertical angles in trigonometrical observations necessary to calculate altitude. Levelling came to Walker’s notice as he worked in the flat plains at the western outskirts of Punjab, where the proximity to the ground of the visual ‘rays’ (lines of sight) that constituted single observations made them prone to distortion in the vertical axis. This phenomenon, generally termed ‘refraction’, was widely discussed among nineteenth-century surveyors. In

73 Edney, Mapping, Ch. 5.  
75 Ibid., pp. 46–9.  
this instance, however, Walker claimed that it presented difficulties that con-
confounded the levelling technique employed on triangulated surveys throughout
India of taking vertical angles by theodolite. For Waugh, meanwhile, the Great
Indus Series was prominent among an array of considerations that seemed to
necessitate new levelling techniques. The error figure in the altitude calculated by
connected trigonometrical series that ran from sea level at Hooghly in Bengal to
sea level at Karachi was, Waugh complained, ‘not sufficiently in keeping with the
wonderful precision attainable in all the other results of the survey’. The
ongoing extension of the Great Indus Series deep into the continental interior
sharpened Waugh’s concern. It was, he said, ‘a matter of great interest to bring up
an accurate datum from the sea to the Himalayas, in connexion with the deter-
mination of the heights of those stupendous pinnacles of the earth’. Frontier
peaks loomed large in the Surveyor-General’s imagination as the ultimate
challenge for the determination of altitude by his men and instruments, acting
as a key impulse to the development of new ways of levelling.

The adapted technique, using spirit levels in place of problematic theodolite
observations, emerged through the interplay of a vast array of elements.
Waugh’s numerous instructions and his ongoing analysis of the results of
Walker’s team while they remained in the field constituted attempts at direction
from the GTS’s headquarters in distant Dehra Dun. But the experimentations of
Walker and his retinue in the shadow of frontier uplands at the outskirts of
Punjab diluted and sometimes directly contradicted these centralising efforts.
Walker assembled a levelling party that included newly recruiting Indian
surveyors and assistants. He employed one of these surveyors, Ramchand, on
the basis of previous experience with the German explorer Adolf Schlagintweit
in Central Asia, seemingly overlooking the low regard in which many Survey
officials held the ventures of Schlagintweit and his two brothers. Instruments
came from various sources, including three Troughton and Simms spirit levels
cadged from the Punjab Canal Department. ‘Precision’ measuring devices were
lost en route and those that remained required a great deal of tinkering in the
field to make them work tolerably. Some underwent substantial redesigns,
such as the addition of glass cases to levels to protect them from ‘currents of
air’. Working practices also fluctuated, with surveyors and sets of instruments

80 Ibid., pp. 146–7. On the Schlagintweit, see Moritz von Brescius, German Science in the Age of
Empire: Enterprise, Opportunity and the Schlagintweit Brothers (Cambridge: Cambridge
University Press, 2018).
81 For more on this aspect of instrumental practice in the nineteenth century, see Richard Dunn,
‘North by Northwest? Experimental Instruments and Instruments of Experiment’, in
MacDonald and Withers (eds.), Geography, pp. 57–76; Schaffer, ‘Easily Cracked’.
deployed in varying combinations in an attempt to mitigate against, in Waugh’s words, errors whose ‘constant character gave reason for anxiety in regard to their accumulating tendency in a long line of 960 miles’. 83 The Great Indus Series’ length was not the only distance that mattered to the surveyors and their superiors in Dehra Dun. Waugh and Walker extolled the production of new levels based on Walker’s drawings, a process of communication and manufacture which successfully bridged the 1,500 miles between western Punjab and the GTS’s Mathematical Instrument Department in Calcutta tasked with executing modifications. 84 Walker also boasted that ‘in the whole distance from the sea to Attock’ each levelling observation was exactly equidistant, insinuating that the ‘long line’ of the Great Indus Series that caused Waugh so much anxiety could be mastered by rigorous sub-division. 85

The stories that Walker and Waugh told sought to valorise the sprawling assemblage of people, correspondence, and instruments that constituted the ever-shifting levelling operation on the Great Indus Series, acclaiming its ability (under their direction) to overcome the tyranny of distance. In both his ‘Short Account of the Levelling Operations of the Great Trigonometrical Survey’ submitted to his Survey of India superiors in 1860 and in his paper to the Royal Astronomical Society in London four years later, Walker presented the complex conjunctions of men and instruments he put to work as a pioneering triumph. 86 To his London audience, he compared his undertakings favourably to the levelling executed between Bristol and the English Channel in 1837 for the British Association for the Advancement of Science under the direction of William Whewell, thereby not-so-humbly insinuating that he and the GTS had bettered a leading man of science and institution in the metropole. 87 This element of Walker’s renderings of his operations had a long-term impact. In his Records of the Survey of India published fifty years after Walker’s ‘Short Account’ (and shortly before his own appointment as Surveyor-General of India), Sidney Burrard stated that ‘in 1858 Indian levelling was started upon correct and scientific lines’. 88 Burrard’s acclamation of Walker’s undertaking echoed Waugh’s assessment that ‘the work was most ably and scientifically executed’. 89

In this supposedly monumental feat of ‘planning and calculating and adjusting and making secure’, it is tempting to detect Heidegger’s ‘World Picture’ in

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the making. Yet Waugh’s report and Walker’s narratives indicated something quite different as well. Both detailed their immense frustration at an insurmountable gap between the survey data and the territory. The newly developed levelling practices meant that ‘differences between observers were much reduced’, but only ‘in some cases’ did Waugh judge them to have been ‘counteracted’. Despite increasingly intricate systems for noting errors and computing corrections, Waugh opined that ‘it is, humanly speaking, impossible to level an instrument practically without some residual error’. Walker, meanwhile, lingered in his paper to the Royal Astronomical Society on the ‘good deal of uncertainty that exists in reading the [standard] level’, owing to optical distortion of the air bubble within the liquid by which readings were taken, ‘which some observers might guard against more than others’. Despite the promises of spirit-levelling to have ‘no place for personal errors’ on the part of individual surveyors, the experience of the operation in the Great Indus Series ‘lead[s] to the eventual conclusion that these [errors] may be the largest and most serious of all’. Moreover, Walker avowed, these ‘discordances’ between individual observers appeared to have been ‘continuous’ in stable conditions ‘of bright sunshine and calm, such as is of frequent occurrence in tropical countries’. His admission acted contrary to his earlier effort to raise the colony above the metropole, suggesting instead that, in this respect, climate terminally disadvantaged the Subcontinent relative to the British Isles.

Waugh and Walker’s accounts exhibit profound ambivalence to the capacities of surveying. While aggrandising the amalgamations of men, missives, and machines that constituted the GTS as it extended to the mountain fringes of the Subcontinent (and taking extra care to foreground their own roles in these processes), they also pondered the seepage of subjective perceptions into survey data despite their intricate efforts to stem the flow. They acknowledged that this practical shortcoming had effects well beyond the field. It could not be elided through sleights-of-hand in centres of calculation and compilation but instead impacted trigonometrical surveying’s epistemological status. However intricate the instruments, however efficient the passage of materials in networks spanning key offices across the colonial Subcontinent, however well suited to specific terrains of plains or hills the working methods, however ‘scientific’ the structure of checks and balances applied to the calculation of altitude, the experience of the Great Indus Series led leading surveyors of British India to perceive that human fallibility would always intrude, constituting an unbridgeable void at the most fundamental level between map and territory.

Just as the advance of trigonometrical surveying to the edges of colonial India’s frontiers from the 1850s had a major impact on the perceived epistemological limits of survey data, so too did it have substantial effects on maps as material objects. It coincided with significant shifts in the production and dissemination of spatial representations of the colonial Subcontinent. This was much more than mere temporal concurrence: effectively representing frontier spaces was among the elements driving the Survey of India to turn to new methods of image reproduction. The Survey’s earliest attempts at the unusually laborious, materially intensive, and delicate process of colour lithography were motivated by the desire to depict the extreme topography captured in recent surveys of the Himalaya and portions of the Punjab frontier by allowing for visually striking altitude shading.  

These attempts were variously successful. The sheets of the Himalaya surveys were widely celebrated, winning a prize medal at the Great Exhibition of England in 1862. On the other hand, an attempt at reproducing a map of the Derajat region to the west of Punjab was a thorough failure, with ill-aligned printing stones and warped paper proving inadequate to the task in hand. The introduction from 1865 of photographic reproduction techniques at the Survey’s printing office, following instruction from the Ordnance Survey in Southampton, seemed to have particular merits for frontier maps. Far quicker than lithographic reproduction, which required the preparation of stone imprints for each image, photozincography was heralded for fulfilling what the head of the India Office’s Geographical Department Clements Markham termed ‘the great demand in India ... not for highly finished, but for rough accurate maps’. Senior surveyors also assumed it would have the benefit of reducing reliance on the ‘often uneducated ... Natives’ who were an integral part of lithographic reproduction. Photozincography was put to use during frontier military expeditions and the Second Anglo-Afghan War (1878–80), when it allowed for the swift dissemination of such ‘rough’ maps of relevant regions to army officers.

95 Ibid., p. 330.  
99 An example of such a map for use at the northeast frontier, on the 1874 Dafla Expedition, is Cambridge University Library, Maps.B.364.87.1.
This was not, however, a case of the unmitigated triumph of imperial technologies for representing space. The Surveyor-General acknowledged that printing these map-images on calico rather than paper to make them sufficiently hard-wearing to take into the field slightly reduced printing precision and rendered them 'not so well suited for the insertion of correction and additional matter'. By the early twentieth century, the leading frontier surveyor turned London-based man of science Thomas Holdich critiqued photozincography for producing 'crude unfinished-looking sheets which might well lead to an impression of absolute inaccuracy'. These comments remind us that high imperial surveyors and map-users understood maps as working documents designed for specific purposes, which had particular flaws and limitations, rather than perfected and authoritative representations. The demands of depicting frontiers and using maps in them pushed the Survey of India to explore new methods of production that were tolerably fit for purpose. And while leading survey officials extolled the supposed successes, they also fretted over drawbacks and limitations, understanding maps as imperfect material artefacts rather than idealised assertions of spatial mastery.

In some important respects, maps and map-series covering frontier and ‘trans-frontier’ spaces were consolidated and rationalised through processes that began in earnest from the 1870s. Up to this point, the most widely circulated maps of the northwest and northeast frontiers were relatively small-scale images manufactured on an individual basis. Many of these images drew upon (and acknowledged) numerous sources, combining disparate information and representational conventions with some difficulty, and often recycling idiosyncratic details from the originals. Map-images of particularly sensitive frontier areas were also produced on an ad hoc basis. Commercial presses such as J. B. Tassin’s Calcutta-based operation produced frontier maps for public consumption. In part this gap in the market existed because the Survey’s own printing capacity was very limited at this time, which also meant that frontier maps such as the 1856 ‘Map of the Trans-Indus Frontier’ had to be sent to London to be lithographed – work that apparently proceeded at a leisurely pace.

From the mid-1860s, the number of maps of frontier regions in circulation increased with the expansion of the Survey of India’s printing department. In

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102 See, for example, maps of Hazara during the 1850s: NAI Cartographic, Survey of India, F.11/11 (1851 image); NAI Cartographic, Survey of India, F.5/17 (1856 update).
103 IOR/X/1562/1–4: J. B. Tassin’s Map of North-Western Frontier (1848); Phillimore, *Historical Records*, Vol. 5, p. 325.
1864 to 1865 more than 3,000 lithographed copies of the six-sheet ‘Map of the North-Eastern Frontier of Bengal, Bhootan and Assam’ were produced. A series of trans-frontier maps to represent both trigonometrical surveying and the route surveys of British and Indian explorers was initiated in 1871 to 1872, with the intention of ‘[proving] useful in studying questions connected with any part of our extensive frontier or with any of the foreign territories lying beyond it’. Accompanying written route plans were printed ‘for the use of travellers who are constantly applying to [the Survey] for such information’.

A ‘North-Eastern Frontier’ series was produced from 1884, with multiple editions of most sheets produced to accommodate new survey data. The Intelligence Branch, founded in 1878, took centre stage in compiling and representing spatial information concerning frontiers in map-images and route books, including for military parties sent to enact violence beyond administered British India. In addition, frontier areas were finally included within the published sheets of the ‘Atlas of India’ project, which had been initiated in the 1820s and was to remain incomplete when superseded in 1905.

A number of factors belied the impression of order given by the incorporation of frontier spaces into new and existing map series. Many sheets within these series continued to draw on multiple data sources, combining various surveying techniques and levels of details. They often contained large blank areas and codified uncertainty in forms such as question marks after toponyms and dashed lines to convey conjectural river courses. A typical example was a note in a 1911 map of uplands to the north of the Brahmaputra Valley: ‘Broken lines on this map indicate conjectural features. The position of many villages is doubtful’. Such omissions were not necessarily prompts to expansion or even further surveying, contrary to J. B. Harley’s reading of terra incognita on European imperial maps in the North American context. For instance, the incumbent Surveyor-General opined in 1861 (wrongly, as it turned out) that the patchy data gathered on the northwest frontier during the 1850s were ‘the best and only information we are ever likely to possess’ for the sheets of the ‘Atlas of India’ covering the region.

There were also perceived problems with the circulation of even those series

with large print runs. Holdich claimed in 1906 that there was ‘little or no outflow’ of maps ‘into the thirsty regions of the frontier’, meaning that ‘officers commanding frontier stations were often lamentably ignorant of their own immediate geographical surroundings’. 111 Many maps, even those in series that aspired to even and universal coverage of portions of the colonial Subcontinent, contained unmistakable marks of fallibility and did not necessarily contribute to projects of frontier administration.

These images were also only an element within a far broader array of frontier spatial renderings produced in the later decades of the nineteenth century. Despite the ostensible strategic sensitivity of the regions to which it pertained, new information on frontiers seeped well beyond the colonial state’s departments and personnel. There were significant exchanges of information pertaining to India’s frontier regions with French, German, and Russian geographers during this period. 112 These communications resulted in quirks such as the first map of one journey into Central Asia by ‘native explorers’ being produced not in India or Britain but in Germany by the founding editor of the prominent geographical journal Petermanns Mitteilungen (who apologised for the image failing to do ‘full justice’ to the survey information). 113 The cultural cache of India’s frontiers often strained or overrode imperatives to secrecy. 114 As in the case of the Lushai Expedition’s ‘Correspondents’ for the Indian Express, agents of empire disseminated spatial knowledge in a range of guises blurring the boundaries of the official and the public. Survey officials were central to the increasing prominence of depictions and descriptions of frontier and trans-frontier spaces in books, periodicals, newspapers, and the meetings and journals of learned societies, especially the RGS. 115 These processes and publications constituted an explosion of fascination among agents of empire and various publics in colony, metropole, and beyond, which was both effect and cause of the bursts of colonial expansion from the late 1860s. The term ‘explosion’ alludes not only to the quantity of representations but also their frequent mutual incompatibility. Their impact was diverse and dynamic; India’s frontiers were not subsumed within unitary and rigid modes of cartographic depiction.

112 Waller, Pundits, Ch. 9; Royal Geographical Society archives, London (hereafter ‘RGS’), JWA/3.
113 RGS, JWA/3: August Petermann to J. T. Walker, 27 March 1869.
114 On J. T. Walker’s uneasy relationship with the Government of India on issues of secrecy concerning explorations in Central Asia, see Waller, Pundits, Ch. 9.
115 The leading surveyors and publications involved are detailed in the remainder of the chapter. Among the earliest books to foreground frontier surveying was R. G. Woodthorpe, The Lushai Expedition (London: Hurst and Blackett, 1873). T. G. Montgomerie began reporting the work of Indian surveyors to the Royal Geographical Society from the late 1860s.
2.4 Sites for ‘Sore-Eyes’: Surveying in Frontier Regions from the Late 1860s

Let us return from offices, printing presses, and learned societies to ‘the field’. The complex and sometimes contradictory nature of colonial knowledge of frontiers during the explosion of the later nineteenth century was not only a product of multiple representations and audiences. Surveyors and ‘explorers’ were often at the crest of the imperial wave as it broke over portions of India’s fringes. From the outset, however, they relied on a host of others: military escorts, locally embedded administrators, and, not least, informants and labourers drawn from frontier populations. The aims, actions, and spatial imaginaries of the heterogeneous actors involved in networks of surveying were frequently far from coordinated, which could have substantial effects on survey data and representations. Perhaps surprisingly, professional surveyors in particular interpreted their roles and the spaces in which they operated in multiple ways. It is to some leading instances of this variation that I now turn, taking forward the story of the Great Indus Series and focusing on moments of crisis during the subsequent decades in which established surveying practices, instruments, and representational techniques seemed inadequate to comprehend India’s frontiers.

During the 1850s and 1860s, frontier surveying generally took place from distant vantage points, consisting primarily of theodolite sightings of topographical features beyond the colonial state’s administrative limits. Surveyors were primarily concerned with issues of accuracy, seeking to discipline refractory instruments, generate robust working practices, and find means by which the vast distances involved in cartographic data production and transmission could be overcome. Despite their feverish (and not infrequently fever-ridden) activity and efforts to foreground successes in their narratives, they acknowledged their frequent failures to innovate and maintain methods that worked tolerably well. To an even greater extent than the Great Indus Series, trigonometrical surveying in Assam proceeded fitfully and relied on compromises and ad hoc experimentation in working practices to counteract the ‘truly lamentable’ progress. The glacial pace of progress up the Brahmaputra Valley led to the abandonment of a core principle of the Survey of India that triangulation preceded revenue surveying, forming ‘the colossal skeleton’ from which the ‘sinews and flesh’ of the latter could hang.

116 On the complexities of such reliance in the exploration of Central Africa, see Fabian, Out of Our Minds, Ch. 2.
118 NAI Cartography, Dehra Dun Vol. 431: Walker to W. G. Beverley, i/c Assam Valley Triangulation, 28 August 1873.
Obtaining good sightings with theodolites was a recurrent concern. In contrast to variable refraction in the northwest, visual occlusion in Assam occurred because of profuse vegetation and smoky haze generated by agriculturalists’ fires to clear ground for crops. Later surveyors heavily criticised the fixing of frontier peaks during these surveys, suggesting that haste and visual obstructions had caused prominent mountains to be mistaken for each other.

Two central aspects of frontier trigonometrical surveying in the mid-nineteenth century – observing frontiers from a distance and the problematic of ‘accuracy’ – altered during the following decades. Trigonometrical and topographical survey parties began to enter frontier regions and lone route surveyors, including ‘native explorers’ or ‘pandits’, went beyond into Tibet and Central Asia. While concerns over limitations to the accuracy and coverage of survey data persisted as mapping parties took to the frontier hills and deserts, a new anxiety arose among surveyors and others engaged in the construction and assessment of spatial knowledge. Many frontier surveyors and other interested agents began to express what might be termed ontological doubts about whether the numerical data of trigonometrical surveying and the maps that followed could constitute true or complete spatial knowledge. Even as technologically advanced trigonometrical surveying spread to the very outskirts of colonial influence in southern Asia, alternative means of understanding and representing frontier spaces seemed increasingly valid and necessary.

A key aspect of British scepticism towards spatial knowledge of frontier India concerned the roles of Asian people. Non-Europeans were involved in frontier surveying in many forms, ranging from porters, to informants and guides, to assistant surveyors. Only in rare instances was their involvement perceived to achieve the kind of ‘circulation’ between British and Indian actors that Kapil Raj has identified in the case of Thomas Montgomery ‘transforming’ his Indian assistant Abdul Hamid into ‘an intelligent instrument of measure’ able to conduct route surveys in frontier regions. There were fierce debates in India and in metropolitan institutions, especially the RGS, over the reliability of data generated by Indian route surveyors. The ‘pandits’ had many steadfast supporters, especially among British frontier surveyors such as Thomas

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Holdich, but other men of geography opined that their data required exceptional validation to make it dependable.¹²⁴ For instance, the retired Indian Army officer and orientalist scholar Henry Rawlinson argued that the ‘value’ of one ‘native explorer’s’ narrative was ‘very much enhanced by the fact that his notes had been put together by the Head of the Survey Department, General Walker, whose name was a sufficient guarantee of minute accuracy of detail combined with sound general views of the physical geography of Central Asia’.¹²⁵ Racialised notions of variable expertise meant that data produced by non-European personnel were prone to doubt and contestation. In many other cases in frontier locales, knowledge did not circulate between surveyors and local informants, instead meeting immovable obstacles.

British surveyors in the Lushai Hills during the 1880s complained at length of difficulties in fixing villages on their maps as the inhabitants of the hills employed various naming practices and many of the villages moved with annually shifting cultivation.¹²⁶ The Surveyor-General noted that in maps of much of the Lushai Hills, he and other surveyors ‘considered [it] useless to show the village sites or enter the names of the chiefs, as the information would soon be obsolete’.¹²⁷ This region of swidden agriculture seemed fundamentally inimical to the type of fixed information represented on the Survey of India’s maps. A distinct difficulty with ascertaining place-names in frontier locales showed on the opposite side of the colonial Subcontinent during a survey operation in 1898 in Malakand. In his public-facing account of this venture, the young journalist Winston Churchill reported a farcical solution to the impossibility of obtaining reliable information when racialised assumptions dominated geographical knowledge production.

Our guide . . . squatted on the ground and pronounced the names of all the villages, as each one was pointed at. To make sure there was no mistake, the series of questions was repeated. This time he gave to each an entirely different name with an appearance of great confidence and pride. However, one unpronounceable name is as good as another, and the villages of the valley will go down to official history, christened at the caprice of a peasant.¹²⁸

¹²⁵ Rawlinson, quoted in Walker, ‘Four Years’, p. 87.
In this case, toponymic data gathering was portrayed as a comic venture, facilitating the creation of maps that fulfilled the formal expectation of representing named places but lacked any pretension to accuracy. Churchill’s anecdote gestures towards moments of incomprehension in the encounters that constituted spatial knowledge even in the era of trigonometrical surveying, which surveyors understood to destabilise the authority of colonial maps.

Another perceived barrier to obtaining spatial knowledge of frontiers was the reliance of large trigonometrical survey parties on a significant number of labourers to carry unwieldy equipment such as theodolites, plane tables, and food supplies. In forested uplands of the northeast, recruits from nearby hill regions were also made to clear ground to enable observations. Obtaining labour was frequently fraught with violence, and in many cases colonial officials found effective communication with porters impossible. The lead surveyor of a triangulated series stretching to the Burmese boundary reported in 1882 that ‘I turned the telescope to search for the first of my new stations, and found that the hill had not been touched, but that, through laziness probably, my cutters must have taken to a low hill at half the distance, on which I saw a signal put up’. What colonial personnel derided as indolence was often a result of porters being overburdened and poorly equipped to deal with harsh conditions. One expedition into the Mishmi Hills to the northeast of the Brahmaputra Valley left half of the thirty-strong portage party frostbitten, with some requiring partial amputations of their feet. The violent and practically problematic use of local labour by survey parties generated difficulties that impacted the quantity and quality of the data collected and showed up as sparsely detailed areas in resulting maps.

When they entered regions beyond the full administration of the colonial state, survey parties often induced fierce resistance, as the march of military retinues coupled with demands for food and supplies constituted an intolerable intrusion. A British surveyor understood Lushais to perceive thirty-foot-high survey marks for theodolite sightings as ‘effigies of [Queen Victoria], placed on their hill tops as evidence of her greatness and the power of her army to penetrate where it would’. This perhaps provides a distorted glimpse into how threatening survey materials and practices appeared to some unadministered communities. On other occasions, it seems that frontier inhabitants objected specifically to colonial surveying and maps. One surveyor reported that a community to the north of Assam agreed to allow him into their hills only


131 Woodthorpe, Lushai Expedition, pp. 193–94.
on the conditions that he journey without his military retinue and ‘provided I made no map for the Queen to see’.  

Violent resistance could impinge on the material ensembles crucial to colonial cartographic knowledge. Accompanying an army column through the Kurram Valley during the Second Anglo-Afghan War in 1878, the surveyor Robert Woodthorpe was shot at. Although his body was merely grazed, ‘a piece of his clothes [was driven] into his sketch book, which was considerably damaged’. The bullet had a material impact on the knowledge generated from an opportunistic foray into an otherwise inaccessible region, highlighting the fragility of even the least sophisticated elements within the instrumental repertoires of surveying. Woodthorpe also avowed that on the same expedition, ‘the circumstances of hasty marches and hostile people’ who deliberately destroyed target marks for theodolite observations rendered the resulting data less accurate than they should have been. The limitations of the survey showed on the map that followed, which contained details only in the valleys and left the uplands largely blank. Here as in many other instances, ‘silences’ in maps were not only the product of wilful colonial elision as Harley posits but also of all manner of ‘states of disrepair’ in the complex and delicate assemblages of humans, instruments, and communicative technologies that constituted cartography in high imperial frontiers.

Surveyors’ perceptions of resistance to their activities in frontier regions often refused any strict division between human and non-human elements. Nature appeared purposive and threatening. In his diary of a military-survey expedition north of Brahmaputra Valley in 1884, Woodthorpe noted: ‘we were attacked but not by Abors: the river had risen rapidly & suddenly a great wave coming down [sic.] like a wall’. When attempting to comprehend and convey their more troubled attempts to know frontier spaces, agents of empire often anthropomorphised features of the landscape. One administrator in the Naga Hills claimed to his superior that the Lanier river, flowing through the hills, ‘has finally laughed us to scorn by disappearing through the great

134 On the importance of notebooks as instruments of exploration and survey, see Eugene Rae, Catherine Souch and Charles W. J. Withers, ‘“Instruments in the Hands of Others”: The Life and Liveliness of Instruments of British Geographical Exploration, c.1860–c.1930’, in Macdonald and Withers (eds.), Geography, Technology and Instruments of Exploration, pp. 139–60.
136 NAI Cartographic, Survey of India, F.113/10.
138 Schaffer, ‘Easily Cracked’.
Saramethi range instead of continuing on in its northerly course ... the very reverse of that we had all anticipated”. Colonisers’ sensations of becoming objects of derision tended to be powerful: we might think of George Orwell’s comment some decades later that ‘every white man’s life in the East ... was one long struggle not to be laughed at’. To those concerned with knowing space rather than just governing people, topography could be every bit as mocking as humans. The explorer Francis Younghusband, meanwhile, conceived of the landscape in Gilgit as actively restrictive when writing of ‘precipitous mountains which forbade [his travel companion] following any route than that which led down the valley of the river he was in’. Surveyors’ and explorers’ attributions of agency to particular features of frontier landscapes were numerous and significant. Collectively, they indicate that agents at the fringes of the colonial subcontinent often perceived themselves surrounded by all too lively natural forces, under threat of being mastered by all they sought to survey.

During the later nineteenth century, surveyors increasingly felt that climate and terrain in frontier India presented major impediments to generating satisfactory data. Although when viewed from a distance or summited with favourable conditions, mountains were integral to the production of spatial knowledge of India’s frontiers, being among the peaks and ridges often undermined trigonometrical and topographical surveying. In written accounts, many frontier surveyors oscillated between admitting the cartographic shortcomings induced by extreme topography and celebrating these elements in the course of aggrandising their own labour. This was particularly apparent in surveys north of Assam from the mid-1870s on, which tended to accompany military expeditions, giving them limited time and few opportunities to rectify shortcomings. Woodthorpe and his retinue were unable to progress far into the Miri and Mishmi Hills in 1877 and 1878 as although ‘the few inhabitants of the country were friendly, ... the physical difficulties were great and the weather most unfavourable, rain poured in torrents, rendering the jungle paths almost impassable, and greatly impeding the movements of the party’. Operating in broken terrain with few major paths, the surveyors were forced to travel by unusual means. A keen artist (see Section 3.4), Woodthorpe delighted in sketching his travails and pronounced himself satisfied with the ‘very fairly reproduced’ lithographed version of one image for the GTS’s annual report (Figure 2.3).

Clearly, the labour of surveying mattered to Woodthorpe and his...
institutional superiors, the act of crossing the Dibong River by a ‘curious kind of bridge’ being presented as an exotic curiosity and a heroic undertaking. But the sketch also indicated Woodthorpe’s inability to progress far through the frontier hills. This shortcoming showed on maps that relied on this survey, including the 1882 Indian Atlas sheet covering the region, which contained blank patches and one sizeable tract without topographical detail labelled ‘uninhabited jungle’.


ASA, Maps No.1079: Indian Atlas, sheet 138 N.W.
Occasionally, reaching a frontier summit afforded surveyors viewpoints from which to take in far greater expanses than was possible in lower areas. But often lines of sight remained limited and underwhelming: in the northeast especially, fog and smoke from fires used by both jhuming and sedentary agriculturalists rendered the sightings necessary for trigonometrical and topographical surveying ‘an absolute impossibility’. During his trigonometrical work in the Naga Hills during the 1870s, Woodthorpe reported that mist limited the visual field to ‘the country immediately bordering our march’. The resulting observations were akin to those on a route survey rather than the comprehensive triangulation intended.

Reporting to his superiors on his work in similar atmospheric conditions on the opposite side of the Brahmaputra Valley eight years later, Woodthorpe repeated a phrase he had employed in his private diary in the Naga Hills, admitting that he identified some topographical features through “‘guesses at truth’”.

Topographical surveying could be even more difficult than triangulation in labyrinthine hills. As the Surveyor-General described in 1865, ‘to execute work of this style, the ground must be open to view, and not hid by forests and jungle, as is very frequently the case; it is often impossible to see the same point from two places’. To hack down forests in order to unveil every topographical detail, he opined, ‘would be too laborious and expensive, and would cause much havoc and injury’. For this reason, surveys in the Khasi and Garo Hills during the 1860s were conducted at half the standard topographical scale. Surveyors engaged in the region also estimated distances to particular points from a single view, meaning that the accuracy of data seemed to the Survey of India to depend to an even greater extent than usual ‘on the skill and integrity of the Surveyor’. All manner of problems could compromise these very qualities, not least the extreme prevalence of illness including one case that struck at the visual foundations of topographical surveying, self-diagnosed as

The lack of internal checks and balances in topographical surveying (unlike trigonometrical surveying) further exacerbated these problems, the only method of verifying data being to re-survey. When such work was undertaken in the Khasi and Garo Hills, it was discovered that the surveys of the 1860s contained such ‘very glaring discrepancies’ that the ‘offending Surveyors’ were fined and dismissed. Defective data continued to be unearthed over a decade later, requiring laborious revisions to maps of the area.

The expansive deserts of the Sind frontier and Balochistan came with their own problems of vision during the simultaneous extension of triangulation, topographical surveying, and reconnaissance work from the late 1870s. The region’s drifting sands prompted questions over the appropriateness of representing it through conventional data and maps. G. P. Tate, who was deputed to the northwestern reaches of Balochistan with the Baloch-Afghan boundary commission in 1895, noted that maps of the area based on reconnaissance work undertaken less than a decade previously were wholly unreliable. The majority of the region, he reported, ‘is covered with a sea of sand-hills’. These were inexplicable by extant western terms, Tate opined, instead requiring Baloch categories of ‘drift sand and those sand-hills which are fairly stable; the former they call bud, and the latter reg or rek’. The extreme temperatures in Balochistan led survey parties to race through as quickly as possible, abandoning efforts at ascertaining altitude by levelling and instead using boiling point observations, which senior survey officials widely disparaged.

Sandstorms and mirages frequently obscured or distorted vision, making it ‘most difficult to take observations during the greater portion of the day’. Adjustments to raw data or the use of different instruments could not overcome these problems. It was not only the sand that moved: the degree of refraction fluctuated wildly and, as one surveyor admitted, ‘delude[d] even the most experienced. Objects invisible at one moment would at the next be seen far above the eye of the spectator’.

Among the high mountains north of Punjab and Kashmir, visual occlusion took another form. In his account of surveying the towering landscape near Chitral in the mid-1880s, Woodthorpe recounted the distinctly limited field of sight. ‘From the low elevation of his route’, he wrote,

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155 Ibid., p. 5.  
158 Ibid., iii.  
160 De Prée, General Report 1883–84, x.
it is seldom that the traveller sees the higher peaks and ranges on either side. His view is bounded by the bare precipices and fantastic pinnacles of the lower ranges, and as he crosses, with discomfort, the shingle slopes every [sic] ready to move down under his weight, he gazes upwards with wonder at their vast height and at the frowning rocks above.\footnote{162}

A photograph on the following page, labelled ‘Bridge and Path, Chitral’, reinforced the integral features of this space as described in the text. The image is significantly underexposed, and its right quarter wholly occupied by a dark, looming cliff (Figure 2.4). A small, silhouetted figure stands on the narrow path bounding the cliff face – the same path from which the photograph was taken – with a river lurking below.

In stark contrast to Romanticist landscape images depicting an individual occupying the ‘summit position’ above the surrounding environs,\footnote{163} neither the

\begin{figure}
\centering
\includegraphics[width=\textwidth]{Bridge_and_Path_Chitral}
\caption{G. M. J. Giles, ‘Bridge and Path, Chitral’ (1885) © The British Library Board.} \label{fig:bridge-and-path-chitral}
\end{figure}

\footnote{161}{Ibid., facing p. 15.}
\footnote{163}{I have adopted the term ‘summit position’ from Peter H. Hansen’s account of modernity and mountaineering, The Summits of Modern Man: Mountaineering after the Enlightenment (Cambridge, MA: Harvard University Press, 2013). For more on Romanticist images of individuals within landscapes, see Hugh Honour, Romanticism (New York, NY: Westview, 1979), pp. 78–79.}
photographer nor the figure in shot has a privileged vantage point. They are trapped within the maze of mountains, with no immediate prospect of attaining the surrounding heights. The photograph portrays the overwhelming scale of the surrounding terrain while supporting a narrative of the intrepidness of those men who laboured through it. Surveyors’ tales of being overcome by the scale and knottiness of frontier spaces were, then, simultaneously expressions of anxiety and self-attributions of heroism. The tension maintained in these accounts and images represented instances in which the surveyors’ vision was not so much that of Apollo, gazing down serenely, as that of fallen Icarus, or of Dionysus, befuddled and intoxicated by the surrounding grandeur.\(^\text{164}\)

2.5 ‘A Higher Land’: Theorising the Unknowable Frontier

When vision failed or seemed unreliable, surveyors and explorers often admitted a sense of being lost in frontier space. The sense of being engulfed by the vastness and complexity of frontier landscapes is especially apparent in the soldier-mountaineer Charles Bruce’s claim that a party of troops marching through the high peaks of Chilas ‘had to all intents and purposes disappeared into space’.\(^\text{165}\) In contrast to the immovable labyrinths of uplands, the danger of deserts to the British lay in their lack of features and mutability. A report written by a newspaper correspondent who travelled with the surveyors and political agents of the Baloch-Afghan boundary commission told of how a number of guides became separated from the main party in ‘a perfect hurricane’ and ‘were only accidentally found, nearly dead’. The correspondent continued, ‘One can imagine no more horrible death than that from being lost in this desert country’.\(^\text{166}\) The overriding sensation that many surveyors and explorers conveyed not only to the adventure-hungry public but also in ostensibly authoritative reports to institutional superiors was that of being overwhelmed by frontier spaces. In such instances, we can discern a ‘sentimental’ protagonist akin to the figure that Mary Louise Pratt identifies in many British travel accounts around the turn of the nineteenth century.\(^\text{167}\) The appearance of the narrator in accounts of frontier spaces as a man ‘composed of a whole body rather than


\(^{167}\) Pratt, *Imperial Eyes*, Ch. 4.
a disembodied eye’ to whom ‘things happen . . . and he endures and survives’ suggests that the travelling, corporeal self was not always minimised or erased in knowledge-producing ventures in the later nineteenth century.\textsuperscript{168} Instead, this subject was not only revivified but enhanced by a distinct formulation of the spaces in which he operated. Unlike British representations of India’s jungles and uplands in the earlier nineteenth century as dangerous but also amenable to improvement,\textsuperscript{169} the mountains and deserts of the high imperial frontier were generally constructed as unreformable.

The significance of this shift is apparent if we consider the man whose writings most vividly expressed the benefits of maintaining frontiers as fundamentally elusive spaces in which to lose oneself: Francis Younghusband, the explorer, Indian Army officer, and later President of the RGS. In both official and popular accounts of his explorations in the late 1880s and 1890s of the high mountains between northern British India and Central Asia, Younghusband first expressed the spiritualist leanings that were to become an integral feature of his perceptions of geography and empire. ‘Separated from the haunts of civilisation by chain after chain of inhospitable mountains’, he wrote in his official report of an 1889 mission to gather knowledge of routes between Kashmir and Central Asia, ‘I seemed, indeed, to be intruding on the abode of some great invisible but all-pervading Deity – the Emblem of Eternal Rest – and to have risen from the world beneath to a higher land’.\textsuperscript{170} Notwithstanding his fastidious perusal of \textit{Hints to Travellers} to learn the basics of surveying, and his rendering of numerous map-images,\textsuperscript{171} Younghusband later conveyed that his experiences north of Kashmir led him to doubt the efficacy of disenchanted vision alone. ‘Clearly it is not the eye, but the soul that sees . . . The whole panorama may be vibrating with beauties that we ordinary men cannot appreciate’.\textsuperscript{172} Younghusband’s conception of the mountainous frontier as an essentially spiritual space, the seminal features of which could not be fixed by a mechanical gaze nor represented by maps, were widely communicated and deemed sufficiently credible for him to reach the institutional pinnacle of imperial geography. He was also far from alone in describing portions of British India’s frontier as exceeding conventionally knowable space. George


\textsuperscript{171} See RGS, GFY/1/4: Younghusband’s copy of \textit{Hints to Travellers} used on his 1887 overland journey from Peking to India.

Robertson, a doctor in the Indian Army, wrote of his travels to the same region a year before Younghusband: ‘the fantastic thought arose in my mind that behind that transparency, that translucent cloud-film, a veritable faery country had been revealed to me, stretching far into the nothingness beyond.’

Feeling lost, not being able to trust sensory data, and experiencing a connection between self and surroundings that eluded description or depiction: these were exactly the sensations that many high imperial explorers and surveyors sought, and claimed to find, at India’s frontiers.

These men also perceived that topographical features or spatial knowledge could become ‘lost’ at frontiers. In a heavily illustrated paper to the RGS on the uplands north of Punjab and Kashmir, Younghusband labelled a moodily stylised rendering of a jagged mountain, from a drawing by the senior surveyor Henry Tanner (of whom more shortly), ‘a lost snowpeak, Hindu Kush’ (Figure 2.5). Notions of being adrift also occurred in some attempts to extend trigonometrical series into the frontier hills. These undertakings had to depart from previously ‘fixed’ stations, requiring that the surveyors first rediscovered such a station. Moments of belated connection with existing series were celebrated as near-providential events. But at other times no such connection was made. One such instance was the survey of the Mishmi Hills at the turn of the twentieth century, undertaken to rectify the omissions of Woodthorpe’s party with its crossing of the ‘curious kind of bridge’ two decades earlier. The lead surveyor found that the many of the stations established twenty years earlier in the Assam Triangulation Series had been entirely carried away by the different large rivers, and the forest had everywhere grown up to such an extent which not only made it very difficult to find such stations as were still extant, but which, when they were found, rendered it impossible to see anything from them without an expenditure of time and labour in jungle-clearing which, in the present instance, it was not possible to undertake.

These circumstances meant that trigonometrical calculations in the frontier hills could not be integrated into the GTS’s grid that spread across colonial India: the entire survey itself was lost, unmoored from the rest of the triangulated subcontinent.

Into the last decades of the nineteenth century, there remained a strong concern among imperial agents with obtaining the types of appropriately noted theodolite sightings and topographical details that were taken to constitute accurate survey data. There was also a keen awareness of the potential

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limitations to obtaining such information, along with plentiful discussion of what constituted appropriate cartographic representation. However, frontier surveyors and officials during this period increasingly called into question whether survey data and maps could ever convey the truth of frontier spaces. Some suggested that the extreme topography and sublime vistas that formed the essence of frontiers demanded direct experience and could not be reduced to textual or visual representations, especially not a top-down, flattened map perspective. Frontier maps were prone to sceptical receptions, especially from those with first-hand experience of the regions represented. Take, for example, a Punjab frontier official’s claim in his 1890 memoir that ‘to look at a frontier map, even one of those famous India Office “large maps,” . . . does not convey much idea of that country’.177

Surveyors’ accounts of frontiers increasingly diverged from Edney’s observation that colonial geographical narratives were ‘textual equivalent[s] of the purely mechanistic vision that creates an unassailable distance between the observer and observed’. Instead of ‘reject[ing] self-reference’ such that ‘geographical observation was turned outward from, not in toward, the British self’, surveyors in the late nineteenth century described themselves as thoroughly

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entangled with the surrounding environs. Many accounts placed the surveyor’s vulnerable body centre stage. In his memoirs, Thomas Holdich described himself at the high mountain summit of the Takht-i-Suliman in 1883, ‘chained ... to the theodolite in spite of chattering teeth and numbed fingers’. Holdich and most other frontier surveyors also wrote extensively in both published accounts and official correspondence of the journeys they undertook to reach the sites at which they collected their data. In contrast to Tim Ingold’s claim that agents of modern western knowledge presented processes of data collection as a uniform series of immediate and static observations, frontier surveyors’ accounts freely attested to involuntary corporeal movements and celebrated improvised instrumental practices. Admitting the potential failings of knowledge production seemed a price worth paying for the opportunity to emphasise heroic labour.

As part of this tendency to place themselves within the landscape, surveyors frequently invoked sublime aesthetics. One instance was G. P. Tate’s popular account of surveying the Neza-i-Sultan, a steep-sided shaft of rock near the meeting point of the Persian, Afghan, and Balochistan borders. ‘It was a brilliant moonlit night’, Tate wrote, ‘and the shaft of the great mass of agglomerates standing out against the dark blue sky oppressed our minds by its towering heights and vast dimensions. The description we had read of this stupendous column in Sir Charles Macgregor’s book entirely failed to convey the impression we derived from our visit to the Neza’. His description implied that certain features of the frontier could not be accessed from removed representations, the immersive experience being accessible only from a grounded, embodied vantage point. The critique of Macgregor’s recent written description indicated that imperial spatial knowledge was far from cumulative or uniform. And Tate’s view of the scene was a disconcerting experience, not an exercise in assured mastery and stable understanding.

One of the most significant attempts to formulate alternative modes of representing frontier spaces appeared in the writings of one of Tate’s contemporaries, Henry Tanner. Tanner was part of a generation of surveyors whose work centred on the fringes of the colonial subcontinent, ranging from Balochistan to the high mountains north of Punjab and the Himalaya around Darjeeling and north of Assam. His concerns returned to the problems of understanding altitude that had been in play since the extension of triangulation...
to the mountainous fringes of British India under Andrew Waugh. After leading a trigonometric survey party to Gilgit in 1879 to 1880, which claimed to have ‘fixed’ 145 peaks beyond the bounds of administered British India, Tanner became acutely aware of the shortcomings of data collected when working among frontier mountains and valleys. ‘I do not wish it to be understood that the points have the accuracy of those hitherto accepted by the Great Trigonometrical Survey’, he stated, since he was able to take observations from only a few viewing points owing to the difficulty of moving among the valleys and passes of Gilgit. Individual observations were also liable to inaccuracies, Tanner warned, as ‘on some of the peaks it was necessary to place the instrument [theodolite] at the very edge of giddy precipices, and then, sometimes, one only of the verniers of the horizontal limb could be read, and that with considerable risk and difficulty’.  

Here once again we see agents of imperial cartography ‘trembling’, but, contra Latour, choosing not to ‘purify’ these experiences through narrative elision and instead admitting the epistemic consequences of their fallibility even in official correspondence.

Under these circumstances of dubious instrumental practices, Tanner turned to alternative registers to convey the landscape. Even his official report to the Survey of India overlooked data, instead focusing impressionistically on the ‘fantastic shapes’, the ‘vast wilderness of isolated mountains’, and ‘the faint, cloud-like group round [the high peak] Tirich Mir’ that he had discerned as he stood at Gurunjur, then the most northerly station connected to the grid of GTS triangulation. In the same narrative, he characterised the view of the northern slopes of the huge peak of Nanga Parbat as ‘the most magnificent snow view on the globe’, beyond description by his ‘feeble pen’. In a retelling of his vision of Nanga Parbat to the RGS in 1891, Tanner delighted in the absolute removal of this frontier scene from British India, saying: ‘Facing you stretch the slopes of pure snow, untainted with the dust of the plains.’ Having taken charge of the Darjeeling and Nepal boundary surveys, which afforded opportunities to observe the highest Himalayan peaks further to the east, Tanner returned to question of what constituted knowledge of mountain spaces at the fringes of the subcontinent. Far from being rectified, his faith in the possibility of precisely calculating the heights of these peaks continued to wane. ‘From an extensive experience in Himalayan surveying’, he wrote to the Surveyor-General in 1884,

I can safely state that even when carrying on our work with the aid of the best maps, instruments, and requisite knowledge of surveying, we are liable, until we compute the

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positions of our points, to mistake one mountain for another, even though we may have learnt their appearance by heart from other stations... Two of my assistants last year mistook other mountains for Everest, and I myself recorded “Everest” against a mountain 5,000 feet lower than it.¹⁸⁶

In this same report, Tanner admitted that he assumed different distances to Himalayan mountains even after numerous theodolite observations, giving a range of possible altitudes and ‘never pretending to fix the peaks absolutely’.¹⁸⁷

As well as freely admitting the difficulties of ascertaining altitude and the tendency for the Himalaya to remain elusive even after extended experience of them, Tanner suggested the limitations of defining high peaks by altitude above sea level. In his 1884 report and again in the paper he gave to the RGS in 1891, he provided a table comparing various mountains in the Greater Himalaya along with Mont Blanc.¹⁸⁸ The table relegated the importance of altitude—the metric that Waugh had couched as the pride of GTS operations, but which Tanner merely termed their ‘accepted’ rank—and instead advanced the heights of the faces of these mountains relative to the surrounding topographical features as the true measure of their significance. By this measure, he crowned Nanga Parbat, which was widely celebrated and depicted in non-map forms by his contemporaries in the survey cadre (Figure 2.6), as ‘king of mountains’. His rationale for this alternative measure was aesthetic. Notwithstanding his claim that Nanga Parbat ‘baffles description’, Tanner described his experience as a grounded observer taking in the north face of the mountain in 1880:

It is a scene that is not grasped or taken in at once, but after a while the stupendous grandeur of the view is appreciated. It is quite overwhelming in its magnitude; it is in fact one of the grandest spectacles that nature offers to the gaze of man. Great height, vast breadth, and appalling depth are combined, and like the panorama of the Tibet snow, as described to me by Captain Harman, it is “immense.” There is nothing small or mean about it; it is on a scale which is gigantic.¹⁸⁹

In rendering Nanga Parbat, Tanner evoked the sense of gargantuan scale and hints of terror that were central constituents of the sublime. His conclusion that Nanga Parbat’s unique importance lay in its ‘immense’ and ‘gigantic’ appearance also provides an opening for understanding the distinctive character of late nineteenth-century frontier surveying from what went before and elsewhere: through reading it alongside Martin Heidegger’s notion of ‘the gigantic’. Heidegger posited that ‘the gigantic’—for example, huge numbers in the sciences and the annihilation of distances through technologies—advances as modern man ‘brings into play his unlimited power for the calculating, planning

¹⁸⁸ Ibid., xxxiii–xxxv; Tanner, ‘Present Knowledge’, p. 408.
and moulding of things’. This conception broadly accords with familiar renderings of high imperial mapping that foreground its fantastically huge calculations and supposed power to generate univocal renderings of space. But in exploring what was at stake in conceiving frontier spaces in late nineteenth-century British India, we should work with Heidegger’s subsequent claim that as soon as the gigantic... becomes a special quality, then what is gigantic, and what can seemingly always be calculated completely becomes, precisely through this, incalculable. This becoming incalculable remains the invisible shadow that is cast around all things everywhere when man has been transformed into subiectum and the world into a picture. By means of this shadow the modern world extends itself out into a space withdrawn from representation.

Tanner’s admission of the limitations of trigonometrical surveying in the face of the ‘gigantic’ scales at play in frontier topography points towards the ambivalence that Heidegger conjures here. The seeming triumph of immense technological assemblages centring on a masterful subject – in this case the extension of theodolites, men, and instrumental paraphernalia to some of the

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most intractable places on earth—seemed simultaneously to reveal a margin that remained elusive and unknowable through such means. This margin developed from the realisation among leading surveyors engaged in the Great Indus Series during the 1850s that there was an irreducible gap between raw survey data and territory, and thereby a limit to cartographic improvement. By the 1880s and 1890s, the concept of ‘a space withdrawn from representation’ took on an enhanced, distinctive form among frontier surveyors and explorers. Often construed as both integral constituent and ultimate product of the construction of the world-as-picture in ‘the modern age’, as the nineteenth century drew to a close maps seemed to many surveyors whose fieldwork undergirded them to be unable to represent frontier spaces in full. These regions instead seemed to demand embodied, spiritualised experience. Having developed the means to calculate them completely enough for almost any practical purpose, surveyors insisted that frontier environs had become incalculable.

2.6 Conclusion: ‘Clean Out of the Map’

Surveyors and explorers of Tanner’s era began to call into question the value and meaning of survey data in regions that seemed to call for embodied, sublime experience. Frontiers went from being the ultimate challenge for calculation and representation, to instead become spaces that called in question the ability of such practices to constitute true and complete spatial knowledge. Immersed in the vertical and horizontal expanses of the high imperial frontier, surveyors imagined themselves to be ‘clean out the map’ not only in having ventured beyond extant cartographic knowledge but by virtue of being in locales that seemed to reveal the limitations of such knowledge.

This chapter has shown how the rigours of trigonometrical sightings of frontier regions in the mid-nineteenth century caused leading surveyors in colonial India to perceive an irreducible margin between survey data and territory. It has suggested that agents involved in frontier surveying were intensely aware not only of the potential shortcomings of producing data but also of representing it, extensively pondering the labour-intensive processes of producing and circulating maps. It has traced the appearance of seemingly intractable barriers to the successful prosecution of surveys when trigonometrical parties began to enter frontier regions in the later decades of the nineteenth century. Finally, it has suggested that one key development of this era was the advent of a widely shared notion of frontiers as spaces that eluded map representation, demanding alternative modes of engagement. In sum, the

chapter presents surveying and spatial knowledge in the era of high empire as an altogether more fraught and uncertain endeavour than has been generally understood. Far from considering themselves masters of the surrounding terrain, surveyors and explorers were sharply conscious of limitations to survey data and maps that could not always be elided or fixed at a later stage. Unlike their predecessors in the jungles and uplands of the subcontinent, they did not maintain faith in the possibility of adapting and improving the landscapes in which they were entangled, instead maintaining that these regions posed challenges of an insurmountable nature. They were altogether more reflective and reflexive – and their numerical, written, and visual representations were far less assured and monolithic – than many recent accounts of modern imperial cartography have allowed for. A shadow accompanied their attempts to proclaim their own heroism and celebrate the gigantic technological assemblages that they put to work: the idea that frontier spaces could overwhelm both the surveyor’s self and the knowledge he produced.

This oscillation between celebrating and fearing the notion that India’s frontiers exceeded representation was among the earliest and most influential doubts among British agents of empire over the value of spatial knowledge. Concerns first expressed in the 1860s that opportunities for ‘discovery’ were becoming ever sparser drove a pervasive sense of crisis in British imperial exploration and geography around the turn of the twentieth century.194 And as Priya Satia has elucidated, a conjuncture of cultural or ‘metaphysical’ uncertainties, preferences for a pure, minimalist aesthetic, and epistemological doubts generated among imperial agents of the early twentieth century the notion that Arabia was a ‘land of mirage, myth, and imprecise borders’.195 To Satia’s list of factors we can add the prevalence of officials who had cut their teeth at India’s frontiers among the British cadre in the Middle East.196 As this chapter has evidenced, a similar set of concerns encompassing knowledge, self, and spirituality were entangled with understandings of high imperial India’s mountain and desert outskirts. Going ‘clean out of the map’ may have expressed limits to spatial knowledge but also provided a new playground for men bored by unprecedented imperial domination.