Chapter 6: Maps: Cultural Apparatus of Space-Economy

The map is a crucial technology of control over space. Map production over centuries went through various transitory phases to arrive at what we equate them with today - as images of spatial realities. Whether the spaces precede maps or maps preempt geopolitical realities is a debate which has been dealt with and intrigued the minds of numerous scholars from across disciplines. Benedict Anderson, for one, points out how indebted present day nationalisms are on enumerative and geographical artifacts namely the census, map and the museum. In this chapter, I shall discuss the instrumentality of maps in fashioning geopolitical realities in concrete spatial terms. After exploring briefly, the historical evolution and transformation of maps in the post Renaissance West, I shall focus on cartographic practices and cultures of map production in England. My objective in this chapter, remains, as in the earlier ones, to see the geographical artifact of the map as an ideologically constructed representation of space, as are landscape paintings or travel writings. Maps, and such other representative artifacts of modernity act as a demiurgic force that mediates the experiential reality of space and imbues it with a superficial structural value. Further, it is the map, which is the visual apparatus which envisions space as territory and inscribes it with power. The formation of Great Britain as a geopolitical reality, its existence as a nation, is as much chequered by and entrenched in such assumption of power as is its empire in the eighteenth and nineteenth centuries. I intend to argue in this chapter and the next, that the map and its acclaimed scientific principles were as much used in fashioning the spatial conglomerate of Great Britain as was in forging the empire in territorially visible terms.

Maps as ideological constructs

The map, which seems to be a simple and natural a representation of landscape, is in fact, a highly artificial construction. There is no word for 'map' in any European language. The word used today derives from late Latin 'mappa', a cloth by way of “mappa mundi”, a
cloth painted with the representation of the world. In some other European languages, it derives from late Latin 'carta', which meant any sort of formal document. Hence the art/science of construction of maps is called cartography. According to P.D.A. Harvey, the development of maps in Europe was more or less complete and standardized by the sixteenth century. Tracing a history previous to this, the ancient Greeks had developed a theory of geography allied to their knowledge of distant lands acquired by military expansion and commerce in the Roman empire. This culminated in the work of Ptolemy whose treatise on geography was accompanied by maps of the world as known to Europe. He was the first to devise a system of grids, though later realised as faulty. According to Ptolemy, the goal of “chorography is to deal separately with a part of a whole”, whereas the task of “geography is to survey the whole in its just proportion”. Simultaneously, he also asserted the theoretical distinction of the global and the local, the whole and its parts. Christendom produced very different maps later on, which were probably influenced by Babylonian sources, circular in shape and Jerusalem at the centre. Most of these early maps, however, were pictorial in form. The modern topographical map was quite a late development.

However, scholars have drawn our attention to the constructed nature of maps. They have been used for military and political purposes in being able to graphically represent an idea of space. Its capability of providing knowledge about specific locations have helped in formulating strategies of defence or fortification through ages. Properties of scalar fixation and graticular accuracy and thus the map's equivalency with the world outside were later additions which gradually took shape in post Renaissance Europe. As David Harvey puts it, the Renaissance invention of perspectivism furnished an entire set of fundamental qualities such as objectivity, practicality and functionality to map making. The cartographic image, then, is a visual reproduction based on a technology of signs invested with the unique power to imitate what is thought of as the real world:

it manages, without any apparent effort, to replace a natural world beyond our physical control with the promise of mental order wrapped in the Euclidean rhetoric of 'poyn, lyne, angle or measure'.

In the previous chapters, I have shown how space is visualised and narrativised. In this chapter, I shall deal with the final stage in the conceptualization of space in the process of its

332 Cited in Harvey 1989a. 245.
333 Ibid. 245.
334 Klein 2001. 3.
reproduction: that of measurement of space by mapping it. The grid provided the structure to absorb the inflow of new information which ordered the distribution of life, population and societies across the globe. Landscape paintings and travelogues therefore become the correlatives which supplied information about the differential phenomena into the mathematically derived reconciliatory and totalitarian framework of the map.

**Fine art to field science**

Among the many questions opened up by scholarship within the history of cartography is that of the complexity of discourses between art and science which cartography mediates. As Denis Cosgrove points out, the obvious parallelism between map and pictorial art emerge from both the practices being concerned with "technical questions of content selection and emphasis, medium, line, colour and symbolization, and both require similar decisions about form, composition, framing and perspective". A number of historians of early modern art such as Samuel Edgerton and Svetlana Alpers have exposed the shared techniques and interests among Italian and Dutch painters and mapmakers. On another note, Brian Harley sees the essential dichotomy between art and science as disabling and using Foucauldian paradigm locates cartographic practice in the domain of cultural production and as a human artifact at par with any other social practice. What Harley terms the "sacred dichotomy" between science and art is itself a late eighteenth century construction and this is also the time when maps shed their last remnance of aesthetic colouring and emerged into the domain of science under the pervasive scientism of the age. However, the steady veering of map making towards accuracy and objectivity and thereby the deployment of specific instruments to optimise its verifiability definitely shows a transition.

According to Alpers, the link between maps and picture-making is an old one that dates back to Ptolemy's *Geography*. While Ptolemy invokes the analogy of picture making with both geography as well as chorography, he "connects the training and skills of the mathematician to geography and those of the artist to chorography". Having laid this distinction, Ptolemy's own work and his maps were inclined towards the former and employed mathematical principles in working out planar projections of the earth's spheroid. Harvey reads Ptolemy's innovation of the system of grid, as connected to perspectivism in

335 Harvey 1989a. 250.
336 Cosgrove 2005. 35.
337 See Edgerton 1976 and Alpers 1983. *(Specifically the essay 'The Mapping Impulse in Dutch Art').*
338 Ibid. 133-134.
that “Ptolemy had imagined how the globe as a whole would look to a human eye looking at it from outside”. This entails also, an epistemological possibility of perceiving the “globe as a knowable totality”. Therefore, the seemingly infinite space once uninterpretable could be represented and scaled down to finitude following mathematical principles to appropriate the globular space onto a plane surface.\(^{339}\) With the translation of Ptolemy's writings in Renaissance Europe, there came about a resurgence of the his geometrical framework and ideas of linear perspective in projecting spaces and bodies onto plane surface whether in art or cartography elaborated in Florentine artists such as Brunelleschi and Alberti:

> It supplied to geography the same aesthetic principles of geometrical harmony which Florentines demanded of all their art.\(^{340}\)

According to Harvey, however, though, this elevated and distant view could provide an all encompassing view, a territorial totality in effect, it lost out much of the sensuous quality of medieval maps and pictures and generated images “completely out of plastic or sensory reach.”\(^{341}\) The dilution of boundary between what is generally deemed a view and what a map is furthred when taking into account that the specular position constructed within Western cartography is essentially the same for panoramas, picturesque views and other visual delights as discussed in preceding chapters. All of them construct the viewer at its centre at a privileged vantage point with the framed image under surveillance. It posits the power of the mapmaker and the view made available comes mediated through his vision. One cultural construct, that is the vision in maps is used to negotiate another cultural construct, the space.\(^{342}\)

The use value of maps derives from its ability to convince its users of its accuracy, which too is constructed and culturally mediated by the mentioned relationship between the viewer and the viewed. Renaissance maps, while maintaining their aesthetic qualities, took on this quality of scientific precision and accuracy which were increasingly being valued for determining property rights, political boundaries and navigation. English estate maps belonging to the age were no less regarded than works of art. The decoration in these maps was an integral part of such maps. William Leybourne, in his instructive treatise to surveyors, *The Compleat Surveyor* (1653), lays down the format and aesthetic principles for cartographers to follow, for, “Your plot”, he says:

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339 Harvey 1989a, 246.
341 Ibid. 244.
342 Ryan 1996. 102.
will be a neat ornament for the lord of the manor to hang in his study, or other private place, so that at pleasure he may see his land before him.\textsuperscript{343}

To this effect, Leyboume instructs the map-maker to draw “divers little Trees” in the most important places and to use lively colours for them and for the topographical features. Further, he points out, the coat of arms should be represented in the upper part of the map, “correctly coloured”, together with a compass rose, scale bar and a picture of the manor house, along with a diagram to show where these should go.\textsuperscript{344} English maps continued to include these features till the eighteenth century, when landscapes of estates and their maps eventually parted ways irrevocably, even though, both of these artifacts, even in the eighteenth and the nineteenth centuries occupied similar wall spaces in the lord’s “study or other private places”.

The steady transition of maps from the realm of art to its incorporation in the domain of science is also traced in the history of map colouring which was during the Renaissance and later a highly skilled, and specialised profession. Colour was an important selling point in the general appreciation of the map as an art item. Holland and what was called the Low countries were the hub of European cartographic culture. Alpers speaks about the overwhelming cartographic impulse among seventeenth century Dutch painters and shows how artists at the time emerged from early profession as cartographers. Most of the maps in other European regions were engraved by Dutch and Flemish engravers. Needless to say that cartography picked up elaborate artistic traditions and innovations of the time and place. The profuse baroque decoration of the period allowed the production of superbly hand-coloured atlases. As baroque style succumbed to the spread of rococo, colouring became less flamboyant till such time that colour disappeared altogether from cartouches and vignettes and was used more sparingly on the map face. The bright elaboration of the sixteenth and early seventeenth centuries gave way to the refined, lighter, subtle colouring of the late seventeenth and early eighteenth centuries, before gradually evolving into the austere functionalism of the early nineteenth century. Map colouring underwent its technical revolution from the nineteenth century with the introduction of colour lithography especially after the Great Exhibition of 1851, which eventually rendered the map colourist redundant.\textsuperscript{345}

\textsuperscript{343} Cited in Delano-Smith and Kain 1999. 122.
\textsuperscript{344} Ibid. 122.
\textsuperscript{345} Smith 1928. 36-37.
The next phase in modernising mapping practices came in the eighteenth century with the revolution in surveying techniques. The use of numerous scientific tools and instruments in cadastral surveys and cartography marked its final transition from being a craft to a highly specialised field science. This was possibly a direct outcome of the process of stabilisation of military-fiscal nation states in Europe, and “their attempts to secure more complete and rational control over their own territories, was the mapping of those territories at ever larger scales and across ever more extensive areas.”\textsuperscript{346} Such large scale surveys could hardly be undertaken as individual initiatives any longer and required state support for financial and other logistic aid. One of the most extensive of such surveys during the period was France’s famous Cassini surveys. It made use of a novel technology called triangulation which could function “simultaneously at the smallest and largest of scales” capable of providing the most unambiguous of results, and it thus “represented a dramatic extension of state power, reaching deep down into different landscapes all across a state’s territory.”\textsuperscript{347}

The pervasive encyclopedism of the Enlightenment age incorporated and reconciled multiple viewpoints and generated a new idiom of systematic and disciplined observation, which triangulation characterised. Though triangulation as a practice was initiated in the late eighteenth century, most European states did find it feasible partly because of the heavy expenditure involved, till mid nineteenth century. This was also the time when cartography as an exclusive scientific discipline was accepted in its own right. As Edney points out, Enlightenment order successfully invested cartography with ideas of exactitude and accuracy as separate from other forms of geographical representations be it textual or pictographic, although these too had their own claims to objectivity:

> Enlightenment is central to modern cartography’s self-definition as a “science” because it is then that “art” was apparently purged from maps, thereby freeing cartography’s pristine, scientific core to develop and to progress.\textsuperscript{348}

Mapping, at this time, received its necessary practical adjunct of applied geometry or trigonometry. Significant advances were made in the area with rigorous systematisation of survey procedures. Surveys quantified space along geometrical criteria for purposes both of cartography as well as statistics which determined not only form and extents of land but also relationships between soil and subject, between land and owner.\textsuperscript{349} This also entailed the

\textsuperscript{346} Edney 1999. 191.
\textsuperscript{347} Ibid. 191.
\textsuperscript{348} Ibid. 193.
\textsuperscript{349} Klein 2001. 43-44.
engagement of elaborate scientific instruments, the theodolite, the plane table, the globe which translated social space into sets of tables and diagrams.

Mapping property: private land and the state

Surveys, as Klein sees them, are a phenomenon attached to the larger story of the transition from feudalism to capitalism. Post Reformation England saw land being subjected to new economic forces with the dissolution of Catholic churches and monasteries and with the collapse of the manorial system. This provided stimulation for private property by monetising land. The land itself rather than its produce, became a commodity. Therefore:

The dynamics of a fluid land market affected the ways in which the whole practice of surveying was understood, and its main impact, in the latter part of the sixteenth century, was to gradually naturalise a perspective on agrarian space which foregrounded its status not as a social realm but as marketable commodity.\(^\text{350}\)

Land was now required to be fervently mapped as it frequently changed hands to develop new and exclusive private rights of the owner over his property. So, as landlords and surveyors joined hands, space was produced as a coded order of legible signs. The estate map is the direct articulation of this collaboration. According to P.D.A. Harvey, the estate map was:

a work the estate owner could consult for detailed information about the lands it showed; or he might point to it with pride, seeing it as a graphic epitome of his property, wealth and social position. Often it was clearly designed for display, beautifully coloured and elaborately ornamented. Often signs of wear, and many added corrections and annotations, testify to long service as a functional tool of estate management.\(^\text{351}\)

The overriding reason behind the production of these estate maps was, of course, to indicate that all the land put on visual display belonged to one owner. The cartographic image inscribed with the estate owner’s insignia and coat of arms together with a landscape view of the manor in the cartouche, therefore reflected his manorial authority. The map denoted his social stature accruing from his wealth and property. The map along with the topographical inscriptions were indexical of the lord’s social standing, power and identity in general. Thus, the map acted as one badge of the owner’s local authority. The family coat of arms added on the top of the map were much more than mere decorations, for “the right to these heraldic

\(^{180}\) Ibid 44.

\(^{350}\) Harvey 1996 27.
emblems also incorporated an individual's right, rooted in the past, to the possession of land".  

In England, while an estate map recorded the boundaries of land owned by a particular person or group of individuals or an institution, cadastral maps recorded property falling within a particular administrative unit. However, English cadastral maps often concerned not just a single individual but involved the local community thus called 'enclosure maps' or combined national interests in 'tithe maps'. Most professional surveyors and cartographers of the sixteenth and seventeenth centuries whose role became crucial, in such a transitory economy, mapped estates first of all. The spur to the surveyors was not a metaphysical or intellectual rediscovery of the inhabited space correlative with Renaissance discovery of self: there was a material basis for the action. The economic imperatives of the age urged the landlord "to know his own" (a material counterpart of the metaphysical quest of "know thyself") - a phrase which did the rounds in the survey manuals. The survey not only drew up an inventory of the entire estate, in order to "apportion objective rights of ownership over goods and land" but also for each new prospective buyer to know what he was purchasing. As society became increasingly commercial, socially ambitious and litigious, the surveyor was required to expand his activities and improve his techniques in order to meet the new demands for maps of multifarious practical and symbolical motives. Therefore there was a need to make the techniques competent enough and scientifically advanced to cope with the varied needs of quickly accelerating land market and to achieve accuracy in mensuration.

If maps were increasingly required for property assessment, taxation and revenue, on the other hand, provided simultaneous impetus for their development from the state's end. Consequently, the practice of mapping Britain as a single unit emerged from regional mapping arising out of practices of mapping revenue regimes. The early administrative units in England called county or shire which derived their autonomous status from their ruling heads usually called earls, bowed down to the sovereign jurisdiction of the Tudor court and its revenue regime. Even with the growing class of acquisitive gentry establishing itself on confiscated monastic land, these units remained unaltered. These counties became the units of basic division which constituted the nation and remained so for years to come.

353 Ibid. 112-113.
354 Ibid. 116.
In a study of English maps produced at the time of Queen Elizabeth's reign, Helgerson shows how the English were exposed to an image through maps which "let them see in a way never before the country – both county and nation – to which they belonged and at the same time showed royal authority ...". Maps had an ideological effect in the age in that they strengthened both local and national identity dovetailed with an identity based on dynasties. The maps of this time show the gradual transition from universal Christendom, to dynastic state to land-centred nation.

The county maps of England and Wales has an ancient history commencing in the sixteenth century. The oldest known series of regional maps of this kind is that compiled by Laurence Nowell (1559-1576). They remained unprinted. A direct result of the state's increasing interest in administrative mechanisms, Nowell's *General Description of England and Wales* was a preliminary specimen intended to promote a larger project which purported to include a whole series of individual maps covering the area which Nowell describes in a letter as "our region". The scope of "our region" extended beyond English and Welsh counties to skirt Scottish lowlands and adjoining coastal areas of Flanders and France as well as Ireland. The composition therefore represented not individual but a collective ("our") view of the dominions under the Tudor monarchs. The map's title cartouche inscribed with the crowned Tudor Arms confirms the legitimacy of royal control over the land portrayed. Through a semiotic reading of the maps, Bernard Klein unravels "the political statement of the map", which, according to him is "the description of a space that aspires to the collective vision of a fully anglicized terrain ... translated into an almost physical incorporation of those areas which, viewed from the English centre of power, constitute the outlying regions of an unevenly structured polity, the culturally diverse margins of the Tudor state." The striking inclusion of Ireland, the itineraries noted on the verso etc. indicate a desire to visually master and therefore politically claim culturally diverse but contiguous spaces.

In 1579, appeared Christopher Saxton's collection of county maps as an atlas, which had been coming out individually in the preceding nine years. A 'land-meater' by profession, Saxton's collection of thirty four regional maps is instrumental in organizing subdivisions of the nation. The collection opens with a general map titled *Anglia*, which exhibits the differing cultural composites i.e. England and Wales as a tightly enmeshed single unit, with

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355 Helgerson 1986. 56.
356 Ibid. 62.
357 Klein 1997. 16.
parts of Scotland, France and Ireland hovering at the margins. Though in comparison to Nowell's *General Description*, Saxton presents a much more restricted version of national territory, he however devices a more consistent and homogeneous and thus a unified geography than Nowell's loose one. The thirty four county maps in his atlas are therefore given equal status in the great partnership called the nation: "Anglia offers the central frame of reference to which the individual maps of the shires metonymically relate". With Queen Elizabeth's image on the frontispiece, the atlas points to its being undertaken under royal commission. In fact, his enterprise was achieved under the authority of Queen Elizabeth and patronised by Thomas Seckford, a government official and eminent lawyer, who bore the title of 'Master of the Court of Requests and Surveyor of the Court of Wards and Liveries'. Saxton's atlas not only established a tradition of county mapping which was to continue till the Ordnance Survey in the nineteenth century, but also promulgated the practice of funding by state patronage. Seckford stimulated official interest in the project. The Privy Council issued orders for the continuation of the survey in 1575 and 1576. The proof copies were used for tactical and defensive planning.

The late sixteenth and early seventeenth centuries, which were crucial years in framing the national imaginary, witnessed an expansion of map production. John Norden mapped a few counties, introducing roads and triangular distance tables detailing the distances between towns generally known as Guyde for English Travellers (1625). He intended to call his work *The Speculum Britanniae*, "after the most painful and praiseworthy labors of Master Christopher Saxton, in the redescription of England". Though his method would be adopted later in the history of English cartography, his project was doomed for lack of sponsor. His ambitious schema of recording a series of county histories was likewise stalled. In 1607, an edition of Camden's *Britannia* came out complete with maps, which can be called the second atlas of England and Wales. This contained reductions of Saxton's and Norton's maps after fresh engravings.

The culmination of Tudor cartographic advance was the publication of John Speed's *Theatre of the Empire of Great Britain*, though published in 1611 under the Stuart regime. Speed's atlas is dedicated to James I, the "Inlarger and Uniter of British Empire". Likewise, the *Empire of Great Britain* promotes the concept of spatial unity of the British Isles through

358 Ibid. 18.
359 Cited in Helgerson 1986.
360 Smith 1982, 29.
361 See Chapter Five for a study of Camden's *Britannica*. 206
visually translating the desire onto cartographic plane. The spatial event is replaced by a historical stage, a spectacle - the theatre. The series consists of a separate map of each county in England Wales, besides general maps of each kingdom one for Scotland and five for Ireland depicting its four provinces. As scholars have pointed out, Speed's work was the first to cartographically integrate culturally diverse spaces within a single pictorial unit called the 'empire'.

In Helgerson's analysis, the project of describing Britain's geography was an inherently political act. In his opinion, the land based chorography which identified specific individuals or houses as the owners of spaces mapped, posited a challenge to the idea of the monarch as the sole repository of power and land ownership. There appears therefore, a conceptual split between the visual maps and the steadily gaining sentiment of that of the monarch as the body politic of the nation. Saxton, Camden, Norden, Speed, Drayton and other county chorographers played an inescapable part in creating the cultural and political entity they only pretended to represent namely the nation. However these maps are signifiers of emerging nationhood as they were the means of organizing knowledge not only about the external frame but also about the internal configuration of the nation.

**Map literacy through popular culture**

In the first half of the eighteenth century, along with atlases containing county, provincial and regional maps, maps were a frequent feature in periodicals and guide books in England. The geographical grammars, such as Herman Moll's *A System of Geography* of 1701 or Emanuel Bowen's *A Complete System of Geography* of 1747. However, apart from these exclusively geographical sources, around the middle of the eighteenth century, cartographic works were often contained in popular literary periodicals. Maps became very much the object of curiosity for the elite and middle classes as were travelogues and other fictional contents in the journals. As tools to cultivate polite culture in men and women, these journals were replete with diverse educative, scholarly and entertainment based pieces. That maps of the British Isles should find a place alongside such diverse literary and other topics, points to the fact that maps as specialised field science was an idea generated later. Also such maps were effective in spreading map literacy and an awareness about one's own nation. Some of these were *The Gentleman's Magazine and Historical Chronicle* (f1 1736-

364 Klein 1997. 11-12.
The London Magazine; or Gentleman's Monthly Intelligencer (fl 1747-60), The Universal Magazine of Knowledge and Pleasure (fl 1747-97), The General Magazine of Arts and Sciences (1755-64), The Universal Museum, or Gentleman's and Ladies Polite Magazine of History, Politicks and Literature (fl 1762-64), The Universal-Museum and Complete Magazine of Knowledge and Pleasure, The Political Magazine and Parliamentary, Naval, Military and Literary Journal (fl 1782-90). Many of the maps also accompanied and supplemented travelogues and antiquarian survey literature such as Kitchin's maps in Boswell's Antiquities of England and Wales 1786. In fact, officially, maps were placed under the surveillance of the Committee of Polite Arts. Maps constantly impressed upon the people making them alert to the recesses of their native counties which were, nevertheless, parts of a unified whole, the nation. This surfaced simultaneously with a rise in home tours in Britain, together with a new awakening towards natural history and antiquities of Britain and generally towards its countryside.

It was recognised that good maps had many practical functions:

A complete knowledge of the Situations, Bearings, Levels and other Topographical Circumstances of this Kingdom, being of great use in planning any scheme for the Improvement of Highways, making Rivers Navigable and providing other means for the Ease and Advancement of the National Commerce.

While journals and pamphlets teemed with maps, inaccuracies in existing maps were steadily coming under criticism. County surveys were still based on road traverse, and angled with the circumferentor or surveying compass, processes which continued since Elizabethan times. For example, a correspondent of the Gentleman's Magazine tartly referred to Herman Moll's popular small scale pocket maps as “Moll's little erroneous trifles”. Herman Moll, being a Dutchman, underwent a severe criticism for his highly ornamental style in the typically Dutch tradition. This was the time when Dutch school of cartography had declined and British cartography was competing against steadily progressing French methods. William Baker reiterated the same indictment of British cartography:

That branch of knowledge (though our pamphlet shops are full of boasted surveys) when it is examined accurately will be found [...] excessively low, oppressed as it is with errors arising (not to mention the ill capacity of common Map-makers) from hasty observations without a variety of good instruments.

367 Cited in Ibid. 44.
William Borlase and Henry Baker were the two people who first brought to notice of the Royal Society of Arts, the cause of national cartography. It was concluded that a map encompassing the whole of the nation was urgently required. As Harley mentions, the general climate of opinion in the country favoured cartographic improvement as a crucial signature of national triumph. France had already taken the lead in mapping an entire nation through an advanced scientific process called the trigonometrical survey. There was consciousness even in the provinces in England about Cassini de Thury's trigonometrical survey and map of France commissioned by Louis XV. Therefore, the general demand was to formulate a map of the nation following more precise standards comparable to French advanced cartography. Therefore, after numerous debates and deliberations the Royal Society of the Arts in November 1759, decided to give premium of £100 and gratuity for a specifically trigonometrical survey. A draft of the advertisement which was to announce the remuneration also specified all the instruments which should be used:

The Horizontal Distances of all places in the Map to be taken with the Theodolite or Plain Table and the roads to be measured with a Perambulator and noted down ....

Moreover, a clarification regarding the above advertisement specified that:

The intention of the Words Theodolite or Plain Table ... was to guard against taking the Angles by the Circumferentor or such like uncertain Instruments; but that if the surveys of any Counties taken by the Candidates be done Trigonometrically by a new invented Instrument of known use and certainty, that such Surveys shall be entitled to the premium according to their merit.\(^{368}\)

As a response to the Society's invitation, a large number of county maps were produced in the latter half of the eighteenth century.

**Home and outside**

Since the global map in the fifteenth and sixteenth centuries was practically a three quarters empty canvas, it provided ample scope for inscribing on it, images of distant and newly 'discovered' lands. The first English incursions into the wider fields of foreign cartography began in the sixteenth century with the first known English world map being compiled in 1542 by John Rotz, geographer to Henry VIII. Anthony Jenkinson, a member of the Mercer's Company, was appointed leader of an expedition sent to Russia in 1557 to open up the eastern trade routes for the Muscovy Company. He drew up a map of the country

which was later also used by Ortelius in his *Theatrum*. Early English navigators, such as Chancellor, Drake, Gilbert, Frobisher, Davis and Ralegh, composed maps and charts out of their explorations which caused lively discussions in the court and among the learned at the time. Another world map was compiled by Edward Wright in 1600 to accompany Hakluyt's *Voyages*. The seventeenth century saw further outpour of the cartographic works which increasingly sought to bring the outside world into purview. With the English translation of Ortelius being made available in 1606, there appeared a range of maps based on Ortelius and travels of numerous explorers into the external world. In 1612, Captain John Smith's map of Virginia appeared engraved by William Hole. Smith's *History of Virginia* had four new maps of 'Oulde Virginia', Virginia, the Summer Islands and New England. In 1619, William Baffin compiled a map of the Mughal Empire based on the information given by Thomas Roe. In 1627, John Speed published his *Prospects of the Most Famous Parts of the World*, the first printed general atlas of the world in English. It was combined with the *Theatre of the Empire of Great Britain*, containing twenty-two maps in all including county maps. Reissued in 1631, 1662 and 1676, it later saw addition of new maps of Virginia and Maryland, New York and New England, Jamaica and Barbados, Carolina and East Indies, Russia and Palestine.\[369

From 1698 to 1700, the famous English scientist, Edmund Halley sailed on the *Paramour*, on the first sea voyage undertaken for a purely scientific objective to the North and South Atlantic. The outcome of his travels were several scientific charts. Interestingly, the magnetic chart, in its first edition of 1701, dedicated to William III, shows the Atlantic only. The second edition of 1702 was dedicated Prince George of Denmark, and extended to include the whole world. Probably, this was a token gesture to acknowledge Dutch influences and contributions.

However, in the eighteenth century, British cartography emerged with a strong fervour with increasing colonization and at the face of rising competition from the French empire. By now, much of the once unknown lands had been conquered by the European forces. This was also the age of colonising powers emerge as naval and military forces. Knowledge about these newly acquired territories proved to be not only a fashion of the times, but an ineluctable necessity, at the face of a growing requirement of a certain perception of the geographical space and the extent of area thus possessed.

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369 Tooley 1952. 31-55.
Some of the most aggressive mapping in this century was done by surveyors in North America, the most famous of these being Thomas Jefferys and his successor, William Faden. James Rennell's work in India was not only appreciated, but impacted on British cartography on home soil as well. At around the same time, Cook's Voyages and atlas published in 1773-84 supplied an impetus through an accurate mapping of considerable portions of South and North Pacific and the coasts of Australia and New Zealand. With this, by the end of the eighteenth century, the outline of the world had been chalked and brought before the British public.

While the unknown charmed and filled minds with curiosity, the spaces nearer home were also increasingly being brought under cartographic surveillance. The inhabited locality was as much part of geographic discovery as was the transoceanic world. Whereas the overseas explorers worked towards the larger cause of geodesy, chorography was the subject of domestic exploration producing landscapes of the inhabited space. The geographical and historical detailing of localities was part of the process of realization of the larger space of the nation.

**Triangulation and mapping of the national space**

The national map of Great Britain was the outcome of years of labour of field surveyors. In the eighteenth century, cartography required the self presence of the surveyor on the field as validation or proof for the map's authenticity and precision.\(^1\) Chorography by the eighteenth century, had largely become an insignificant and obsolete field. Chorography, which employed merely vision was not enough any more. The inadequacy spurred a sharp distinction between viewing and observation/examination: as also between an indiscriminate spectator and an insightful observer. At the wake of emergent national consolidation, vision became an immaculate perception configured increasingly by mechanization and scientific sophistication. Thereby measurement became a surrogate to examination or observation. The survey map has been a technology of vision, which employed instrumentalized vision in conceptualising space. This amounted to compile an accurate measurement of that space, which meant in this case, the extent of the territory under the British monarch's command. The survey map's spatial structure was taken as a direct reproduction of the nation's political existence.

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\(^1\) The penchant for survey literature written in a language of science was a parallel phenomenon arising out of the same syndrome. See Edney 1997. 41.
The surveys were political statements, which attempted to fix imperial control over its territories. As Edney says, the perfection of the geographic panopticon and its archive was promised by the use of 'triangulation'. The system was based on measuring an accurate distance between two points on a longitude called the base line, and thus plotting a third point by calculating angles with the help of the optical instrument called the theodolite. The surveyor occupied high vantage points like the peak of a hill or the summit of towers. The adoption of triangulation as a method, marked a shift in the source of propagation of truth and certitude from the site of the office to the field. The cartographic practice was validated by its capability of creating rationally coherent and geometrically accurate geographic space. The “uninterrupted series of triangles” created an image of continuous and connected space. As geo-spaces got chequered by the ever continuing triangles, they invariably got inscribed as imperial space, shaping new geo-political realities such as the nation or the empire.371

Scotland and Ireland were the first to be brought under the imperial gaze of the English monarchy. Though Scotland featured on maps of Britain from Ptolemy onwards, yet its mapping catapulted into a new era with the Culloden suppression of 1746.372 It came into the notice in this campaign and the subsequent pacification of the region, that maps of the Scottish highlands were inadequate and affected adversely the military operation. Lt. Col. David Watson, who was entrusted with the duty to plan and set up army posts and build roads in the newly pacified regions henceforth, found the unreliability and inadequacy of existing maps a hugely crippling. It was Col. Watson, who, under the orders of the government and the army, soon after the campaign, started mapping the Highlands in 1747. Col. Roy, who was once Assistant Quarter Master on this project, later reflected in Philosophical Transactions for the Royal Society in 1785:

The rise and progress of the rebellion which broke out in the Highlands of Scotland in 1745, ... convinced Government of what infinite importance it would be to the State that a country so inaccessible to nature, should be thoroughly explored and laid open, by establishing military posts in its inmost recesses, and carrying roads of communication to its remotest parts.373

371 Ibid. 104-118, 319-325.
372 Charles Edward, the grand son of James II, was the young Scottish Pretender to the British throne. In August 1745, he and his troops occupied Edinburgh and Carlisle and marched as far south as Derby. He was compelled to retreat and finally defeated by the Duke of Cumberland, son of George II, at Culloden in April, 1746, finally putting an end to the Anglo-Scot antagonism.
373 Close 1969. 2-3.
While talking of the existing map thus prepared, which were still in manuscript form, Roy talks of the requirement to recast these maps according to the advanced technological development the time had seen:

Although this work ... answered the purpose for which intended; yet having been carried with instruments of the common, or even inferior kind, and the sum allowed for it being inadequate to the execution of so great a design in the manner, it is rather to be considered as a magnificent military sketch, than a very accurate map of a country.

Close, on discussing the maps of Highlands produced after the campaign confirms the futility of the maps as no better than a skillful military sketch asserting its undue nexus with academic art:

The work is clearly an elaborate compass sketch; the roads and some of the streams have been paced, and the mountains have been put in roughly by eye. Near the towns the work is carefully drawn. Cultivation is indicated by open diagonal hatching. The hill features are shown by rough, faint brush, sepia shading or hachuring; the higher mountains are shown by similar, only darker shading.374

This appears to be the first call for a trigonometrical survey of the region which initiated the process of the Ordnance Survey. Thus, the survey of Scotland helped to bring the country under a unified Parliament. With the Ordnance Survey and William Roy, began a new era of cartography in Great Britain.

Similarly, Ireland came under an English survey based imperial cartographic regime after a rebellion which took place in 1641.375 In 1649, Oliver Cromwell trampled the revolt with the help of a disciplining army and later ordered what was called the 'Down Survey'. In 1653, an Act was passed under the Commonwealth, for the Satisfaction of the Adventurers for Lands in Ireland, and of the Arrears due to the Soldiery there, and of other publique Debts. In the Preamble, it stated:

Whereas many well-affected persons, bodies politque and corporate, did subscribe and pay in, upon several Acts and Ordinances of the late Parliament, divers considerable sums of money by way of adventure towards suppression of the late noted rebellion in Ireland, which said sums of money were, by the said Acts and Ordinances appointed to be satisfied by several proportions of the lands and the rebels there ... 376

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374 Some interesting people were appointed in producing these maps. Though none of the maps are signed, the artist Paul Sandby, who later became an instructor in R M Academy seems to have been on the list.

375 Earlier maps of the British Isles, as discussed earlier, already expressed the idea of incorporating Ireland as one of the components of the national conglomerate.

376 Ibid 100.
Basically, this meant that the property of the Irish rebels was confiscated in the name of meeting the expenses for suppressing and pacifying the rebellion. For this purpose, the Act appointed a committee to conduct "exact and perfect survey and admeasurement of all and every the honors, baronies, castles, manors, lands, tenements, and hereditaments forfeited". These were officially called the 'Down Survey' as they were set 'down' on paper. Benjamin Worsley and Dr. William Petty were jointly named surveyor generals for the operations to chalk out both the settlements of Cromwellian soldiery, and the settlement of 'adventurers'.

It was not till the nineteenth century, that such extensive surveys would be re-initiated. The last official survey before 1824, when the survey of Ireland was resumed, was that made during the reign of William III of the 'Forfeited Lands', but which were not much impressive. The Down Survey, in comparison, still stood as the most effective and accurate assessment. In 1815, the Select Committee met and reported in favour of rendering the assessments more equal. But it was only in 1824 that a fresh survey was recommended in view of more equal apportionment of local tax. It was decided on the insistence of Major Colby that a "central and effectual control is indispensible". The execution of the survey was decided to be given over to the Ordnance Survey which was already 33 years in progress. The Committee concluded its report with:

... all former Surveys of Ireland originated in forfeitures and violent transfer of property; the present has for its object the relief which can be afforded to proprietors and occupiers of land from unequal taxation ... In that portion of the empire to which it particularly applies, it cannot but be received as a proof of the disposition of the Legislature to adopt all measures calculated to advance the interests of Ireland.

The chief object of the Ordnance Survey of Ireland was the marking exactly on paper the exact areas and boundaries of counties, baronies and parishes and townlands.

Colby's scheme of covering Ireland through triangulation was approved by the Duke of Wellington. While the trigonometrical survey of Scotland was in progress, some of the hills in Ireland had already been marked and linked up by intersection to the Scottish hills. These hill stations extended from the Mourne Mountains in County Down to Malin Head in Donegal, hundred and fifty miles in the north east coast of Ireland. For example, Colby mentions the importance of Divis, near Belfast:

378 Cited in Ibid. 107.
The triangles of which it is the apex cover a space of about one hundred and thirty miles in one direction and about eighty miles in the other — no less than two hundred Trigonometrical Points were observed from it.\textsuperscript{379}

The 'heliostat' and the 'limelight', two novel innovations by Drummond were used for the triangulation. The artillery division was entrusted with the field work, who Colby found educated, intelligent and trained in practical geometry. Colby, however, refused to take responsibility of determining the boundaries on the ground. Therefore, the duty of ascertaining boundaries on the ground fell on the Boundary Department, under Richard Griffith, and special boundary surveyors were employed for the purpose.

**The Ordnance Survey: the military take over**

The word 'ordnance' is a syncopated variant of 'ordinance', which is derived from the old French word 'ordenance', meaning a regulation and an arranging in order. In the seventeenth century, the word 'ordnance' came to be exclusively applied to artillery and engineer personnel and material, and the services relating to these. The Board of Ordnance, a defunct organ of the English state, was constituted in 1683 to deal with questions of national defence, ordnance supplies, and the deployment of engineering corps and artillery regiments. Among other responsibilities, the Board was also to act as the custodian of lands, depots, and forts and all overseas possessions. The phrase 'Ordnance Survey' was first used in 1820, whereas the process of its coming into being had began in the previous century.\textsuperscript{380}

Whereas it entailed ideas of fortification, defensible property and spaces, it also amounted to the military take over of an episteme, that of cartography. Therefore, the term ordnance in the expression 'Ordnance Map' retained meanings of both the original and the etymologically derived terms in that it ordered space, as well as transformed it into a military regime or a martially occupied and inscribed territory. There eventuated thereby a sharp distinction between civil and political geography, with maps being increasingly seen as part of the technology of administration and control. The transition was thus symptomatic of transformation of lived and experienced space into an ideologically architected and constructed space.

In the *Philosophical Transactions* of the Royal Society for the year 1785, Roy in an account on the measurement of the Hounslow Heath base line, opens with a general observation that, if a country has not been surveyed, or is but little known, a state of warfare

\textsuperscript{379} Cited in Ibid. 107.
\textsuperscript{380} Ibid. 28.
generally produces the first “improvements” in its geography. So in Britain, “on the conclusion of the peace of 1763, it came for the first time under the consideration of the Government to make a general survey of the whole island at a public cost”. In this project, Roy’s part was to make “the map of Scotland ... subservient, by extending the great triangles quite to the North extremity of the island, and filling them in from the original map”.381 This was the beginning of what Close calls the Accurate Surveys 1783-1790. Another incident which expedited the Survey, was a proposal from France, based on observations by Cassini de Thury in his Memoir that the latitude of Greenwich was in doubt by some fifteen seconds and that in order to determine the correct value it was desirable to connect geodetically with Paris. Though objection was naturally raised to such a statement, it gave an added impetus and was used as an effective lever by the missionaries of scientism and the enthusiasts of accuracy. The adoption of the proposal had deep seated national, political, scientific and practical motivation. Both King George III and the Royal Society were willing to assist in this project to ascertain the difference between the longitude of the two observatories. However, Roy, to whom the responsibility of execution of this project was given, conceived the task in a different way. His principal scheme “has always been considered of a still more important nature [than the mere joining of the observatories], namely the laying the foundation of a general survey of the British Islands”.

It was decided to observe the angles with a large circular instrument called the 3 ft. Theodolite R.S. designed and constructed by Jesse Ramsden the famous instrument maker of England. The volunteers for assisting in the preliminary measurement declined the age old method of measuring with wooden rods for it was accepted that variation in humidity affected their length. In its stead steal chains were ordered at the outset but that too was deemed ineffective. Finally, the definitive measurement was carried out by the most unusual means being used for the first time namely glass tubes of fixed length and diameter. Ramsden was once again called upon to make them suitable for measurement on the field. Also, as a policy,

chiefly with a view to the more effectual execution of the work, it was judged to be a right measure to obtain and employ soldiers, instead of country labourers in tracing the base, clearing the ground, and assisting in the subsequent operations. They would furnish the necessary centinels for guarding the apparatus.

381 Ibid. 12.
This was a crucial change which was to remain for years to come and which irrevocably wrenched away cartography from the artist's hands. Accordingly, a party of the 12th regiment of foot, consisting of a sergeant, corporal and ten men were ordered from Windsor to Hounslow Heath.

The French representatives were three distinguished members of the Academy of Sciences, Comte de Cassini (the fourth Cassini), Mechain and Le Gendre. They arrived at Dover and the two parties seemed to have amicably settled the details of the operations in 1787. the derived difference of longitude, Greenwich-Paris was $2^\circ19^\prime51^\prime$. According to Close:

> It was the first accurate triangulation carried out in this country and set a remarkably high standard; it amply fulfilled its original scientific purpose; it provided for the first time, a thoroughly reliable framework for map making; and it led directly to the formal founding of the Ordnance Survey.\(^{382}\)

Another figure that influenced and aided the national survey to a considerable extent was Charles Lennox, the Third Duke of Richmond who picked up the project and boosted it after a lapse of a few years due to Roy's death in 1790. In fact, it was from the Duke, who was greatly interested in matters of fortification and survey, that the national survey received its earliest and decided support. Bestowing a new confidence on the military, he corroborated "the claims of Ordnance officers to be looked upon as scientific men", and asserted their role in national defence. The existence of the Ordnance Survey itself can be traced to him. After Roy's death, he took the decisive step of putting the survey under the Board of Ordnance in which he held the post of Master-General from 1782-1795, crucial years in British military history. Therefore, the name 'Ordnance Survey', which however, as mentioned earlier, was used much later. In its stead, the expressions such as 'British Survey', 'British Trigonometrical Survey' or 'General Survey of Great Britain' were used. The term which arose from its being regulated by the Board of Survey, finally came to mean and became synonymous with 'survey of the highest accuracy'.

An interesting corollary to the Ordnance Survey was the Royal Military Academy established in 1741. Notably, it was set up not only to train cadet officers or artillery engineers, but a contingent of surveyors and draftsmen. Engineers and gunners of the British Army had to amalgamate with their martial and defence expertise, drafting and architectural drawings. The curriculum consisted of multifarious subjects such as fortification and

\(^{382}\) Ibid. 23.
artillery along with presumably civil components such as geography, drawing, classics, writing, arithmatic, and the art of surveying and leveling.383

Till Roy's death, the operations were carried under the general directions of the Royal Society, with assistance from the Board of Ordnance, while the cost of the instruments was personally borne by the King himself. While the reasons for the continuation of the Survey after Roy's death remains doubtful, the military interest in the project was aroused at the face of possibility of war with France. The military authorities, persuaded by the Duke himself, were convinced of the necessity and value of a trustworthy map of southern England if such a war broke out.

Therefore, within the course of the year, the various negotiations with the financial authorities, with the Royal Society, and with Ramsden and the East India Company regarding the procurement of the second 3 ft theodolite which was meant for the Survey of India, were successfully concluded. Duke of Richmond's plea to the Royal Military Academy, Woolwich to provide him the best officers of the artillery, was also answered. Major Williams, Lt. Mudge and Isaac Dalby were appointed for the job. The official constitution could therefore be taken as the 10th. of July, 1791. Their first task was to remeasure the base at Honslow Heath to verify Roy's assessment, which they began in the presence of Sir Joseph Banks, Dr. Maskelyne, the Astronomer Royal and several other members of the Royal Society. This time measurements were done by steel chains fashioned by Ramsden. The mean of the two measurements was taken as the length of the base. What is remarkable is the constant additions and improvements not only in the geographical data, but also in the technical process of surveying. The first Ordnance map came out in 1801 of the county of Kent and covering parts of London and Essex.

Geodetic experiments

The mathematical and scientific scope of cartographic surveys involved three interlinked ideas. Firstly, the Enlightenment philosophers developed an epistemological ideal believing that a correct and certain archive of knowledge can be constructed. Secondly, on a pragmatic level, there was a call for improved scientific technologies such as 'triangulation' which would provide verifiability and perfection to geographical knowledge. Lastly, the knowledge thus produced had a larger claim to the ability to clinch geodetic abstractions in concrete terms. The field of operation, be it the immediate space of the

nation or the empire, in fact, circumscribed the whole of the earth. The determination of the shape and size of the nation or the empire through surveys, therefore, had an important by-product of gauging the shape and size of the globe as well.

Most of the survey and mapping operations from the late eighteenth century onwards aimed to achieve larger scientific and geodetic goals. The cost and logistics of the endeavours were most often justified in the name of vital scientific information the operation would accrue on the concerned state. The spirit of competition among European nations arising from steadily consolidating nationalist consciousness, initiated a knowledge race, resulting in a knowledge archive to grow and flourish in most European states. Similarly, in imagining Great Britain as the apogee of scientific development, the possession of a constantly updating knowledge data base was a primary urge and also a crucial prerequisite. As spaces near and far, were harnessed and brought under a scalar ordering, knowledge emerging from the processes was also brought under the fold of a science regime, possessed and used to legitimise power and authority and finally give it its meaning. This emerged out of an egotistical drive, (involving both individualistic and communitarian) and strengthening will to omniscience. In Edney's words, during this age: "geographical practices served to establish and legitimate Enlightenment's ideological self-image as an inquisitive, rational, knowing, and hence empowered state".384

The geodetic operation with which the Survey and Mudge's name is closely associated is the measurement of the arc of meridian covering a distance of 196 miles across the British Isles. The objects of this measurement were, first to determine the varying curvature of the meridian passing through the greater part of England, for use in computing the latitudes and longitudes of the triangulation. The second and most important objective was to provide additional information in order to arrive at the correct figure and shape of the earth. Another of Ramsden's novel equipments was used for this purpose, called the zenith sector. The zenith sector was itself an ensemble of various instruments such as an eight feet long telescope and four inch object glass.

However, Mudge's measurement of a single arc of meridian, less than three degrees long, did not give minutely reliable results, or serve to determine the figure of the earth. But the combination of many arcs, both along meridians and along parallels, and collation of information from geodetic observations spread across Europe, the United States and India ultimately helped to arrive at a conclusion regarding the shape of the earth.

On the other hand, latitudes and longitudes derived from the Ordnance Survey were required for nautical charts, especially of the coastline of the islands. At the beginning of the nineteenth century there was considerable ambiguity about the location of islands, especially with regard to their longitudes. The arc of meridian was a crucial by-product with which spaces on earth was determined.

**Nautical maps**

In 1808, Thomas Hurd, the then Hydrographer to the Board of Admiralty, suggested "the necessity of an application being made to the Board of Ordnance that this office be allowed to have a copy of such parts of Colonel Mudge's Military Survey of England as respects the sea coast thereof together with all remarkable objects in the vicinity, as may be judged useful to navigation". The Hydrographic Office was founded within a few years of the establishment of the Ordnance Survey, in 1795. However, the roots of the formation of the office was nearly the same as the Ordnance Survey. It pertained to the necessity of naval defence of the island after the experience of the Revolt in the Scottish highlands, and can be traced to General Roy's piecemeal coastal surveys.

Cooperation between military engineer and hydrographic surveyor was not frequent in the first half of the eighteenth century as was in the latter. It was Graeme Spence, who after retiring coastal survey, was employed in the Admiralty in reorienting another marine surveyor's (Murdoch Mackenzie) earlier compass surveys of the West Country with the recent results of the Grand Trigonometrical Survey then under way.

Meanwhile, Dalrymple, who was formerly hydrographer with the East India Company, became the Hydrographer General to the newly constituted office. With constant prodding, Dalrymple was finally able to garner attention to the need and urgency of marine surveys. "It is a disgrace to this country", he said, "that the hydrography of our coasts is not accurately delineated". He delineated a novel method of marine survey in his *Essay on Nautical Surveying* written while he was Hydrographer in 1806. He named it the 'Quincunx' from an arrangement of trees. It consisted of a central vessel in anchored in the sea surrounded by four smaller anchored vessels arranged in a square. The pattern of the anchored vessels would form a sea triangulation to which soundings and other hydrographic information could be related. The scale of the surveys could be found by measuring the...
distance between any two of the anchored vessels. Dalrymple proposed using the speed of sound when the distance was considerable. Dalrymple insisted:

No other method is competent [sic] to give an exact chart of the Banks and Soundings out of sight of land.\(^\text{387}\)

The quincunx method was never used during Dalrymple's lifetime because the process required too many vessels. Moreover, he fell into quarrel with the Office and was subsequently dismissed.

It was during Hurd's term of office as Hydrographer that the Admiralty chart took on a style which collated triangulation on land and extended it to the coastal areas and the sea. During his term, the surveyor, George Thomas made use of the Dalrymple's method, but with the help of Dickinson Patent Buoy and Beacon machine instead of vessels, because, as Thomas wrote to Hurd

by their height above the water and their perpendicular, as well as fixed position, a series of triangles may be carried out from the shore to any extent within the limits of the soundings.\(^\text{388}\)

In 1817, Hurd entrusted Thomas with the task of proceeding with his survey northwards to the Orkneys and, if possible, further to the Shetland Islands “in conjunction with Colonel Mudge, who, ... , is very desirous of cooperating with you on these parts of the coast”. This association with the Ordnance Survey proved fruitful later in 1825, when Thomas started his detailed hydrographic survey of the Shetland Isles. The primary triangulation of these northern islands had been measured by Colby in 1821, shortly after his appointment as Director in succession to Mudge, but it was left incomplete when in 1825, the attention and resources were entirely focussed towards the six-inch Trigonometrical Survey of Ireland. Thomas, therefore had no other option than first carrying out a large scale topographic survey, to which he could then connect his marine examinations. Thomas' greatest contribution to British marine cartography was the survey of the Orkneys and the Shetland Isles. The survey of the Shetland Isles, marked the first step towards accurately charting the whole of the coastal waters of the British Isles.

Close, two-way collaboration was established with the Ordnance Survey which continued to supply triangulation data, and in turn, naval surveyors provided coastal detail for Ordnance maps. All these developments provided a spring-board for the ambitious re-

\(^{387}\) Cited in Ibid. 129.
\(^{388}\) Cited in Ibid. 129
survey of the coastal waters of Britain known as the 'Grand Survey of the British Isles', which kept the Hydrographic Office preoccupied for much of the mid-nineteenth century.

However, what was called the Grand Survey of the British Isles, saw its completion with Francis Beaufort, who was the Hydrographer from 1829 onwards. Under him, different surveyors were simultaneously employed and engaged on various sections of the coast. In this way, long stretches of coastal areas and home waters were charted including the main navigable rivers. Areas which had already undergone cartographic routine of the Ordnance Survey, were easily surveyed and triangulated by the hydrographer. As the survey progressed, it became clear that the sea bed and the coastal regions are constantly under flux and continuously reshaped by tides and waves. With the limited resources under command, the Office could not dream of the luxury of updating such information on a regular basis. Later in the century, harbour boards were established to tackle this problem at the local level with important ports being given the duty of conducting surveys at frequent intervals thus adding to the marine cartographic archive. Pilot books were issued with updated and renewed information for smooth navigation.

Initially Beaufort's scheme, constrained by slender resources was restricted to charting only the home waters. As the work successfully progressed, the seas of the world came under the purview of marine cartography, flanked by growing mercantile and defence interests of the British state. Soon the systematic triangulation of coastal beds and unknown sea waters curved out and strove to protect land masses under the British dominion located far and near.

Most importantly, the Ordnance and the Hydrographic Surveys jointly, were able to tame the unknown through a systematic plotting which thereby produced a geographically bound spatial entity. This gave birth to a geographic space in visual and thereby comprehensible terms while locating it in geodetic space on the globe. The emergence of Great Britain as a unified nation was the outcome of this joint venture. While the Ordnance Survey brought the inner most recesses of the Isles under surveillance and into public discourse, so the Hydrographic Survey charted the bounds of the dominion, creating a marine frontier. Similar practices were being simultaneously undertaken to carve out the British dominions in its overseas colonies, therefore shaping both the core as well as the

389 There was constant pressure on the Board of Admiralty to make its charts available to the civilian merchant marine. These therefore served not only the needs of increasing traffic generated in rapidly industrializing England, but also raised much needed revenue to finance further surveys. See Delano-Smith and Kain 1999. 225.
The next chapter shall deal with the instance of India as a spatial unit constructed by and enmeshed within practices of British political advancement and its scientific ideology.