SANDARS LECTURES 2007: CONVERSATIONS WITH MAPS
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LECTURE II: GEOGRAPHY IS BETTER THAN DIVINITY – THE PRACTITIONERS' STORY

In the first 'conversation with maps' we looked at how the history of cartography has developed in the mid to late twentieth century, with a view to considering how that has affected our views of the cartography of the early modern period. This took us from the collecting and formation of a canon of great maps, which still fascinates collectors and scholars, to the attempts to describe all types of maps from 'great' to everyday. This is in order to record not just their existence, but to illuminate their production, use and meaning at any one time.

In this second lecture I am addressing what was it the practitioners, i.e. those involved in geography and in making maps and charts of the world in the early modern period thought they were doing and what they said about it to each other and the public; this is the second conversation with maps.

The importance of the practitioners themselves, normally in respect of improving the cartography of the period, has been recognised at least since the publication of the seminal work by EGR Taylor in the 1950s. (E. G. R. Taylor, *The Haven-Finding Art: A History of Navigation from Odysseus to Captain Cook* (London: Hollis and Carter, 1956; new augmented ed., 1971), and *The Mathematical Practitioners of Tudor and Stuart England* (Cambridge: Cambridge University Press, 1954).*See* also the obituary and bibliography of her works T*ransactions of the Institute of British Geographers* (1967), 181-6).

The use of the word 'practitioners' does not imply that they were not educated: some were university graduates. Together they formed a varied group of men who made their livings at least partly from cartographically related work. While it is increasingly recognised that the characteristics of much cartographic activity in the Renaissance derived from earlier periods, notably the portolan chart, thought to have been used since 1200 and that there was a continuing tradition of using written

sailing directions, cartography *avant la letter* did become in this period self-aware. Indeed some have claimed cartography itself at this time as the model for the birth of modern scientific discourse. (Edgar Zilsel, ' The genesis of the concept of scientific progress' *Journal of the History of Ideas* 6 (1945), pp.325-49 and Richard S Westfall, 'Charting the scientific community,' in K Gavroglu, J Christianidis and E. Nicolaidis eds. *Trends in the Historiography of Science* (1994), pp. 1-14, cited in D.Woodward (ed.) *History of cartography* (2007), vol. 3, pp. 22-23).

However important the role of cartography was at this time, it is also the case that contemporaries did not have a settled word for map or for chart, nor indeed did they use the word 'cartography' which current scholarship dates possibly from the end of the eighteenth century as a concept and from 1829 as a specific label for British surveyors in South Asia (see M. Edney, 'The irony of imperial mapping' in *The Imperial map: and the mastery of Empire cartography* (ed. J. Akerman, Chicago, forthcoming 2008). The new cartographic knowledge of the oceans, its routes worldwide, and in particular of the new world, and cartographic skills and their practice still needed a settled name. Maps and charts were often variously known as ' plats', 'plots' (often to do with actual surveying or recording distance and direction travelled, at what we would call large -scale) or else 'cardes' or 'kharts' or 'cartes' variously spelt. This is important as our modern views of the separate and specialist natures of land and sea maps was not necessarily their's. The same practitioners would often do both, besides having other gainful employment in scribing and copying. Nor should they be confused in our minds with amateurs; having a number of jobs and skills was normal for the practitioner.

The usual story concerns the development and reform of mathematical cartography during the period 1500-1700, both on land and at sea. But such a progressive story did not necessarily predominate in all places at all times, and has been overemphasized by singling out evidence of advances leading to later, sometimes much later improvements or breakthroughs; the resulting isolation of the history of cartography at any one time, from contemporary events and from the particular locations in which it arose, has sometimes left the history of cartography bereft of historical interest and significance.

This narrow view, as we saw in lecture I, in the case of books was challenged by D F McKenzie (1985) and by Brian Harley, David Woodward and others involved in the History of Cartography programme of publication in the late-80s. Harley in particular

followed aspects of the ideas of Michael Foucault (Brian Harley, 'Silences and secrecy: the hidden agenda of cartography in early modern Europe.' *Imago Mundi* 40 pp.57-76) and saw maps as discourses of knowledge and power, challenging the usual implicit, and sometimes explicit, claim of modern cartography to be neutral in socio-political terms. More recently, as reviewed in lecture I, scholars like Christian Jacob have seen maps and cartography as cultural entities with something to say, other than representing the advancement of science. There were, of course, those patrons and clients at the time who campaigned for the mathematical reform of cartography and were still doing so throughout the eighteenth century in the attempt, for example, to establish longitude. But this is not the only story and even that story can be given a context, beyond the anticipated triumph of positional accuracy.

Given the changing views about what is interesting to learn about maps and mapping in the past lets consider afresh what can we know about the maps and charts: what were the practitioners actually concerned about, and how did their concerns change overtime in maritime Europe. Were they just getting from A to B? Were, for example, fast, safe and competitive trade routes their ultimate goals? What do the maps and charts tell us themselves, and what did the practitioners actually say about them and how did they actually transmit that knowledge? Were there distinctive schools of practitioners across maritime Europe and how did they operate?

What we do know is that even in the more backward places of production like London, by the 1630s, most of the known world had been charted at least as far as its coastlines went and that the new world of the Americas and the Pacific Ocean was visually commonplace in the new printed maps and atlases of the day. (Slide 3 showing the distribution of MS English chart coverage in 1630).

Difficulties of finding out what was going on in practice

In this section I am going to be concentrating on the manuscript, rather than the printed, and on representations of the world's sea and coastlines rather than on land maps.

There are great difficulties in finding out what was going on; this is compounded by what remains, mainly presentation copies of maps and charts (but not exclusively), and occasional fragments, evidently used at sea or in a map maker's, or

printer's/publisher's work shop or even as waste in bindings or as wrappers. Most of the surviving representations are fair copies of surveys or copy charts and may well have been preserved by being presented to the wealthy or aristocratic backers of various enterprises and then acquired by public collections in the nineteenth and twentieth centuries. There are, however, rough sketches of areas and coastal features taken at the time by the person concerned - shipmaster or soldier intent on working out his campaign - in surviving journals and in the papers in the archives of Western Europe.

In the case of charts, sketches and drafts were taken to a chart maker to make a professional copy chart. We may assume they were passed on and just wore out. Some stray survivals have been used as second hand vellum to make bindings, or were used as wrappers or even cut up and stretched over drums! (slide 4 showing the fragment). The drum skin is a fragment of the world chart of 1610 drawn by the chartmaker brothers, Harmen and Marten Jansz. from Edam on the Zuider Zee. The chartmakers at Edam and Enkhuizen pre-date the establishment of the Dutch East India Company in 1602 and provided charts to the Dutch seamen from 1580s onwards, as did the Thameside chart makers in London.

Similarly in Marseilles there was a group of chart makers from the late sixteenth century to the end of the seventeenth century. This group included the Doran family of chart makers who are first recorded working in London in 1586 for Lord Burghley. This example from Marseilles is in the collections of Cambridge University Library (CUL) (slide 5) and has been described by Jean Michel Massing (London: Burlington Magazine Oct. 1991,no 1063 vol. cxxiii). He identifies the cartographer as Estienne Bremond of Marseilles, and the chart is dated c.1650.

The historian of Italian chart makers 1400-1700, Professor Coradino Astengo has plotted the Mediterranean trade over the period until its decline at the end of the seventeenth century. The large coastal cities and smaller ports of the Mediterranean continued the medieval tradition of producing manuscript charts and atlases. These charts were generally produced in small family work shops; the traditional art of making charts for navigation was handed down from generation to generation. The charts these family workshops produced reveal a sense of continuity, with the Mediterranean maintaining its central position in the world even after the opening of the Atlantic and the waters beyond. Generally, he has found that 'output comprised

numerous charts and atlases that, as in the Middle Ages, showed only the Mediterranean area and nautical atlases that included only a small world chart or dedicated just a few small sheets to the oceans and continents beyond Europe while continuing to focus on the Mediterranean.' (D. Woodward (ed). *History of cartography* Part 1, vol. 3, pp.174-262) Charts of a single area—such as the Black Sea, the Aegean, or the Adriatic—were also produced, like this chart of the Aegean drawn by Bremond.

The chart has an interesting provenance. Apparently it was acquired by CUL by chance, as it formed the lining of a box containing a miscellany of Turkish maps purchased by Roger Fairclough, then the map librarian, for the Library in 1969. The chart shows the Aegean sea from Crete (Candia) to the Bosphorus; Constantinople is on the North side and Uskudar (Escuderi) on the south side. The cartouche shows the initials of the cartographer 'E. B' and then an almost illegible inscription says 'par Estienne Bremond.' The only other chart known by him is in the Huntington Library, California, which bears the words 'Faict a Marseille par Estienne Bremond, 1655.' There was a school of chart makers in Marseilles from this period to the early eighteenth century but, as Astengo has pointed out no one has yet done the bio-bibliographical work for these chart makers of Marseilles.

Apart from this chance survival, certain sorts of charts survived rather than others. Most collections still existing today are connected with royalty or government, which probably favoured the survival of maps recording exploratory voyages or associated with military campaigns and territorial ambitions important to the Crown. This is not, however, entirely the case; the Dutch East India Company (VOC) holds an archive of its own cartography, which Kees Zandvliet (*Mapping for Money*,Amsterdam,1998) has described; this includes many examples of charts made for commercial sailings by the Dutch. Such was the esteem in which the Dutch were held many of the surviving MS Dutch charts are now to be found in collections belonging to their rivals, in particular the French and the English who acquired the charts somehow.

On occasions the connection was much more direct at the time (Slides 6 and 7).

This chart of the Pacific Ocean exemplifies the direct exchange of information and skills between the Dutch and English. It was drawn about 1600 by Gabriel Tatton an English chart maker in Holland, possibly in Amsterdam as the arms of the City of Amsterdam are shown on the chart. He may have learnt or polished his own chart making skills there or in Enkhuizen or Edam the home of the North Holland School

which Günter Schilder has written about ('De Noordhollandse Cartografenschool' in Koeman, C *et al* , *Lucas Jansz. Waghenaer van Enckhuysen* (Enckhuizen,1984 pp.47- 72.) Note the legend at the bottom 'Bii myn Gabriel Tatton van London Englishman' and the lady on the Armadillo, representing America in the top right hand corner which is the same motif as that drawn on this fragment from Harmen and Marten Jansz. map of the world 1610 (Slide 4). The motif was common in printed works at the time and it seems likely that Tatton knew earlier practitioners of the school like Evert Gibertsz. whose chart of the East Indies of 1599 used similar allegorical figures to represent Africa and Asia and Cornelis Doedtsz (d.1613) whose style Tatton also follows. He may have also worked with, or for, the supplier of charts to the VOC from the 1590s, Augustin Robaertsz. who had a very close working relationship with the chart makers of Edam. Whatever the circumstances of this exact connection (which I am still investigating with the advice of Günter Schilder) this chart exemplifies survival by presentation to, or acquisition by, the backers of the exploratory trading and privateering voyages concerned. This chart and other similar ones are, for example, in what now survives of the collections of Sir Robert Dudley (1573-1649) in the Bibliotheca Nazionale in Florence, and in the Statsbibliothek in Munich. Dudley was himself an explorer of the coasts of Guiana in the 1590s and subsequently a collector of contemporary maps and charts in order to compile his own sea atlas, the *Arcano del Mare,* finally published in Florence in 1646-7.

In England the best collections are the Royal collections (now in the BL), those owned by Elizabeth I's first minister, Sir William Cecil at Hatfield House and Burghley House, and those acquired or copied by the antiquary Sir Robert Cotton, also in the BL. Some English collections are in America notably the collection of William Blathwayt as secretary to the Lords of Trade and Plantations (1649? -1717) contained in his Atlas at the John Carter Brown Library.

While these are great collections for the period, anecdotal evidence of the existence of maps and charts now lost implies that many more once existed. In England, for example, ten charts were made for the Earl of Denby, Charles I's ambassador to Persia in 1625; this number would add substantially to the present total of twenty-five listed, for the period 1620–-30. Three of the charts were by John Daniel, the first of the London Drapers Company of chart makers on the Thames. The

Daniel charts owned by Denby, were of the Thames Estuary, covering the coasts of Norfolk, Suffolk, Essex, and Kent (1625), the North Atlantic (1626), and the Mediterranean (1625). A further set of seven charts on paper "fasten'd to Pastboard, written and designed by a worse hand than the former" covering north-west Europe and the Mediterranean, the North Atlantic, the route to the Far East, and China and Japan are also mentioned in the sale catalogue description of 1851. These may be by Daniel's apprentice Nicholas Comberford (d.1673). All of these charts existed in 1851 and may yet be identified. (Edward Bernard, *Catalogi librorum manuscriptorum Angliæ et Hiberniæ in unum collecti, cum indice alphabetico*, 2 vols. (Oxford, 1697), bk. 2, pt. , 39.) The annotated version of the catalogue in the British Library Manuscripts Department indicates that two of the charts listed were acquired by the British Museum from the Earl in 1851. They are of the Indian Ocean (1630) and of the coasts of Ireland, Britain, France, Spain, and Barbary (1626) (Add. MS. 18664.A and B, respectively) and were described in 1697 as *very well written, Painted and Gilded, on Parchment, and fixed to Wooden Cases. By* John Daniel *of* St. Katharine's *near* London. The other three charts listed by Daniel are not recorded as far as I can tell.

Whether these particular charts were better in quality and decoration than those taken on board seems unclear. A few decorated charts survive, which **do** seem to demonstrate that they were used to record the route taken at sea, (there are markings or pricks from compasses on them) as well as a number of pen and ink charts that can be identified as being used at sea. These latter charts, and coastal sketches, are normally found in contemporary correspondence among the various classes of state papers at TNA, in the IOR, or in journals in the BL. A recently discovered pen and ink plot is of the route from the Shetland Isles to the Norwegian coast, ca. 1600. (Slide 8) The route was across the North Sea to Bergen and then up the coast as far as the Arctic Circle. A latitude scale is given on the right hand side. As this was a short coastal voyage there was no need to use the Mercator projection, which subject I will come to later on. A quarter compass rose to give direction is also shown and this is what they would normally use for this type of plotting exercise which recorded the ship's position and rate of progress each day.

Production and influences in Western Europe

For the Mediterranean, and indeed elsewhere, it has been said the map and chart makers moved around 'in such a cloud of maritime polyglot as to render the nationalities irrelevant.' (Wood, Dennis, 'The history of cartography/volume I/review article' *Cartographica* vol. 24, no. 4 Winter 1987 pp.69-78). In London in the sixteenth century, probably because the English were trying to catch up with the Italians, Spanish and Portuguese, this was certainly true. An Italian, Battista Testa Rossa, made a chart in London in 1557 and the Irish-Italians Edmond Doran and his son Hercules worked in London in 1585–-86. Hercules then moved to Marseilles in 1592. The best chart-makers of whatever nationality, but often Portuguese, were sought after as purveyors of technical drawing skills and, of course, geographical and navigational knowledge and were used all over western Europe.

Cortesão and da Mota's monumental catalogue, *Portugalia Monumenta Cartographica* (*PMC*, noted in Lecture I) gives us an immediate and comprehensive view of Portuguese chart making from the late fifteenth to the late seventeenth century. Its sheer size and world coverage reflect the extent of the Portuguese sea-borne Empire and the seminal influence of the Portuguese on other countries' cartographic output, both in providing map-makers across Europe, especially in France and England, and in the use of their maps, either bought or otherwise acquired, sometimes clandestinely. Some 1600 charts are illustrated and more described which make the surviving English contribution to the number of charts surviving in Europe of some 150 charts and other marine representations for the period up to 1660, fade into numerical insignificance.

This relatively slight surviving accumulation, however, is not as uncommon as one might think. Alison Sandman (D. Woodward ed. *History of cartography* vol.3, pt. I pp.1095-1142) has shown that the bureaucracies in Spain involved in navigation and exploration kept copious written records which have survived better than the charts they discuss and it is these records which, of necessity, form a major source for any view of Spanish cartography, especially the nautical. The absence, apparently, of any surviving pilots' charts mean that their supposed contents are a matter of speculation. As she explains, 'the charts sold to the pilots were all supposed to match a central exemplar called the *padrón real*, literally the royal standard or pattern. The *padrón* took different forms over the course of the sixteenth century, when the system was at it height, but the *padrón* was generally drawn on parchment for ease of correction rather than paper. It was supplemented by a book containing statements gathered from

pilots; as late as 1590, this book was kept alongside the pattern chart in a locked box in the Casa de la Contratación in Seville. Though nominally showing the entire world, in practice the *padrón* focused on the voyage to the West Indies, the voyage most commonly undertaken from Seville'.

No surviving chart can be unambiguously identified as one of the pattern charts, though many extant charts are thought to be copies. Most of the extant charts are ornate and were probably intended as gifts. The influence of both the Portuguese and the Spaniards was immense: the former 'exported' cartographers to the other maritime countries, and the latter developed a system for controlling the gathering of up-to-date navigational information on charts and its dissemination to professionals. This latter system was regarded as exemplary by many contemporaries and copied, most notably later on, by the Dutch East India Company.

Academic and armchair geographers

At the same time as the professionals were making and using more up-to date charts and maps, historical geography or, as contemporaries would have said, 'cosmography', was making its appearance in universities together with history and geography and mathematics. The study of historical geography was mostly confined to texts, usually as here (Slide 9 of the title page of Peter Heylin's *Cosmographie*, 3 ed. London, 1665*)*. Peter Heylin (1599-1662) began his career as a practitioner, albeit part-time given his other occupations, as a lecturer in historical geography at Oxford in the second decade of the seventeenth century. He then became much more well-known as a polemicist for the Stuart Government and in particular as a supporter of Laudianism - those who followed the precepts of Archbishop Laud (1573-1645). His career is the subject of a book by Anthony Milton now at press.

Heylin recalls an incident in Jan 1641 when he was up before the Committee for the Courts of Justice, on the complaint of the Puritan William Prynne. He was verbally attacked and jostled for his religious position and support of the Stuart government. He recounts that one particular person whom he encountered in his path thrust him 'rudely from the wall, and looking over his shoulder at me in a scorning manner, said in a hoarse voice these words geography is better then divinitie; and so passed along. Whether his meaning were I was a better geographer than divine; or that geographie

had been a study of more credit to me and advantage in the eyes of men than divinity was like to prove I am not able to determine. But the idea has been borne in upon me to look back at my earlier work.'- this was the *Microcosm* of 1621. This volume contained the collected lectures given by him at Oxford on the historical geography of the world and by 1663 there had been eight editions published. Evidently the downturn in his fortunes at that time and the opportunity to write and publish for money seemed irresistible. But the other point he was making in this tale must surely be that geography, if not better than divinitie, was at least a more neutral subject, and one less likely to get him into trouble. Perhaps this is an early example of the concepts of neutrality and objectivity with which later geographers and, even more so, cartographers have been so concerned to align their subject?

The volume is illustrated by some maps of no a particular design or engraving quality in themselves but up-to-date with geographical thinking of the day, showing California as an island (Slide 10). Presumably these were the best the printer could afford. It was a common enough expedient in publications to use rather poor quality engravings or old Dutch plates: Heylin's older contemporary Samuel Purchas in *His Pilgrimes* (1625) used the maps of Jodous Hondius's *Atlas Minor*, first published in Amsterdam in 1607 to which he referred rather disparagingly as being 'better than nothing'. Purchas's publisher had purchased 55 of the plates at some point before 1621. Purchas is also probably responsible for the popularisation of California as an island by including his friend's - the Cambridge mathematician Henry Briggs's - map of North America showing California, newly, as an island, as seen copied here in 1663 by Heylin's publisher. Some discoveries were after all sometimes mistaken and this is one of them; this misconception lasted a very long time.

Heylin's scholarly motives for publishing the *Microcosm* had originally been: 'The general deficiency which I had observed in this science… Some slightly runne over the world and observe only the oeconomie and politique governement of each kingdome ...' When he decided in the 1640s to return to this work by expanding it into the *Cosmographie,* eventually published in 1652, he tells us in the Preface that : 'In pursuance of this work I have taken on my self the parts of an historian and geographer; [but] I have not forgot I am an Englishman and, which is something more, a churchman. As an Englishman I have been mindful upon all occasions to commit to memory the noble actions of my country, exploited by both sea and land in most parts of the world.' Of importance to him were the many victories in 'France,

Spain, Scotland, Belgium in Palestine, Cyprus, Africk and America… in right of first discovery to Estotiland, [Baffin Island] terra Corterialis, [Labrador], New Foundland, Novum Belgium [shortly to be New England], Guiana and the countries near the Cape of Good hope and some other places….' It is noticeable that the routes and factories established in the East Indies, so fiercely fought over by the maritime powers, and especially viciously in the 1620s by the English and the Dutch, do not feature as claimed spheres of influence or territory, although another disputed territory does - Guiana.

He has a lot to say about the ancients' world views and about the naming of places. In respect of America he says: 'This great tract of land is most aptly called the New World. 'New' for the late discovery and 'World' for the vast spaciousness of it. The most usual and somewhat improper name is America because Americus Vespuccius discovered it; but sithence [*sic*] Columbus gave us the first light to discover these countries, both by example and directions; and Sebastianus Cabot touched at many parts of the continent which Americus never saw why is it not as well called Columbana, Sebastianus or Cabotia? The most improper name of all yet most usuall amongst Marriners is the westerne Indies ; westerne Indies because by that one name [i.e Indies] they expresse all wealthie (if remote) countries.'

This nomenclature harks back to the depiction of the world by Martellus in 1490, which we saw in lecture I, and which described the distance going west to the East Indies and Japan as being far shorter than going east. The old mistaken name of 'West Indies' had taken on another meaning at least for seamen, that of rich lands wherever they were to be found or perhaps more likely the riches of the Spaniards' bullion fleet! Heylin seems to have had some personal knowledge of some more recent discoveries and praises the Spaniards in particular in respect of their discovery of the Pacific.

In terms of places yet unknown, he has chapters on 'Endeavouring a Discovery of the unknown parts of the world, i.e. 'Terra Incognita Borealis' (top of slide 10) and 'Terra Incognita Australis' the great southern continent. He is very dismissive of the northern discoveries, saying (p.1090) 'when I look upon the nature of those shores and seas, those tedious winters of ten months with no summer following, the winds continually in the north and the main ocean paved with ice so long together I cannot chose but rank the hope of these Northern passages amongst those Adventures which are only commendable for the difficulties presented in them. There were in spite of

his views further attempts to get through the North East Passage in the 1670s but to no avail. The lure of a shorter northern route to the East Indies remained.
But he recognises that the motives for continuing in these regions were, by then, whale fishing, 'of whose oil, bones and brain (this last supposed to be the true *Sperma Caeti* now used as medicinal) they raise very great profit'.
As for the southern continent, he supports the view that the earth must be 'answerable in measure and proportion above and below the equator which is the centre'. In other words the southern continent had to be as large as the northern continents to balance things out. He's not sure why the discovery of this continent has not gone on so fast but has some very interesting reasons for this. 'Whether it be that there is some Nil Ultra put to humane endeavours or that this people are not yet made ripe enough to receive the gospel [by God] or that the great Princes of the earth think it no good policy to engage themselves in New discoveries till the old be thoroughly planted and made sure unto them, or that the merchant who in matters of this nature hath a powerful influence thinks his hands full already and being settled in so many and so wealthy factories … Which of all of these or whether all of these together be the cause of this stop I am not able to determine. Certain it is that here is a large field enough for covetousness, ambition or Desire of glory to spend themselves in.'
He then goes on to consider new land on the Moon but doesn't think it likely: a little Heylin joke perhaps?

In terms of historical geography, a better example of a map than that which was inserted into Heylin's work is this map of Ancient Africa with modern outlines by Nicolas Blankaart (slide 11) 'Africae Antiquae edita Nicolao Blancardo Batavo. To Ioanni Brunazo IC.' Nicolas Blankaart (1629-1703), taught at Leiden University and became Professor of Greek in Friesland. He made this and other historical maps for Janssonius's world atlas in 1652. But this was the product of the far superior and commercially successful Dutch publishing industry and reflects that superiority admirably in its execution which London could not match. The success of Heylin's publication which ran into many editions during the seventeenth century gives us a good view of what the English reading public might have known in terms of world geography and history and also the sorts of maps, which were not biblical, they would have seen.

Another world: chart makers and seamen

If we have now seen, briefly, the milieu of the European chart makers and the publishing activities of university men in historical geography, what did the users of charts in particular make of the new knowledge? Let's begin with what the professionals at sea; who were at this period often the practitioners as well as the clients used the charts for? It is necessary to distinguish here between coastal navigation and long ocean voyages. For the former, charts were not deemed necessary in the mid-sixteenth and later, rutters or written sailing directions, notes on coastal landmarks, soundings, and a description of the sea bottom were the shipmaster's way of reckoning where he was and where he was going. For navigation on longer or oceanic voyages, charts were used, but evidence is hard to come by: such as it is the evidence comes either from the wills of sailors or from their surviving journals. The chart was part of the shipmaster's personal collection of navigational instruments, and was normally kept, as one might expect, in his chest with his other belongings. Hair and Alsop's work on the first English Guinea voyages from 1553 to 1565 (Hair, P. and Alsop J. *English seamen and traders in Guinea.1553-65: the new evidence of their wills* Lewiston, 1992) illustrates this point. Notices of "cardes," or sea charts, appear in the wills of some of the seamen who died. It seems ordinary seamen had sea charts as well as the masters, mates, and the agents or merchants on board. Thomas Wilford, master of the Moon, who made his will in April 1554, records that he "geue to William Gardner my greate carde [ie chart]. Item I geue my other carde [chart] to the boteswayne. Richard Hakluyt records an agent William Towerson on the 1555–-56 voyage to Guinea who had a sea chart, apparently a standard Portuguese one, which "to the southwarde I [Towerson] haue approued to be very trewe." Thirty years later the tradition of having the chart as part of the mariner's personal tools of the trade continued. Richard Hawkins setting out on his voyage for the West Indies in 1591 took two days to round up his ship's company at Plymouth and was forced to pay for one of his mariner's charts, which the unfortunate man had apparently given up for security on a loan - probably for drink.

Although Portuguese, and sometimes Spanish, charts were used they were not always viewed uncritically. In 1585, William Borough warned that it was inadvisable to be "tied to the Portugale, or Spanish Marine Plats, which are made by the Card makers [probably he means cosmographers here i.e. those who were not sailors themselves] of those Countries, men that are no trauailers themselues, but doe all things therein, by information, and vppon the credite of others [i.e information from ships pilots]." This complaint about Spanish charts is corroborated by the practice of the Spaniards who did indeed use university trained cosmographers to make their standard charts and who, in turn did not trust the reports of the pilots on Spanish ships when they reported back to Seville. An anonymous Spanish pamphleteer pointed out, if three pilots on the same ship could disagree by one hundred leagues in their calculations of position, their observations could not be considered reliable. The reliability (or lack thereof) of pilots' reports was one key issue in the debates that shook the Casa de la Contratación in the1540s, and despite much discussion, it was never satisfactorily resolved between the pilots on the one hand and the cosmographers on the other. (See Alison Sandman in Woodward, D. (ed.) *History of Cartography* vol. 3 pt. I pp. 1095-1142.) Similar disagreements as to the efficacy of particular methods and use can be seen in other parts of Western Europe between the pilots and the cosmographers. In England fifty years later, Borough was advocating what we may call the pilots view, that "Marine plats ought to be described by such as can give reason and shew observation of everie perticularitie contained in the same, as well as the latitude of places."

Edward Dodsworth, agent on board the New Yeeres Gift, recorded in a memorial of a voyage to the East Indies in 1614–-15 that the channel between the island of Madagascar and the mainland was laid down erroneously by the Portuguese: "for that in our plattes, laide downe by the Portingalls, the sands [lie] thirtye leages from the shoare." He further remarked when sailing through the Maldives that "we founde manie shoaldes and ilandes laide in the plattes most false and eronious, which, as we maie conjecture, is lade downe by the Portingalls to make those seas seme more daingerous unto us." Here we have the added suspicion of deliberate falsifying which may not have actually been the case as the Maldives were notoriously difficult to survey. One hundred and fifty years later Alexander Dalrymple was still trying to fix the Maldives. It is clear, however, that the practice of using Spanish, Portuguese, French and later Dutch charts for those coasts where the English were not first-comers

continued until at least the middle of the seventeenth century. Only very slowly did the English made their own draft surveys and then employ chart-makers to make charts from them to provide further copies.

Graphic world views: experimenting with projections.

Apart from the content of the maps and charts the practitioners had other concerns about cartography; this was about the actual construction of maps and charts. This was not a settled matter. The world view was not that of consensus at practitioner level at all, more experimental and disputed. There were often long running disputes about cartographic and navigational matters, from the measurement of the distance of the newly found Pacific Ocean, over views of how far the East Indies were from the Iberian peninsula, to the variation and declination of the magnetic compass, to the use of a particular prime meridian – the point from which the 360 degrees of longitude are measured -- and especially on the efficacy of particular projections or no projection for portraying the whole spherical world as a flat map on paper or parchment.
The disputes were normally between on the one hand cosmographers and mathematicians and on the other the ships masters and pilots, as well as, presumably, those chart and map makers who were expert enough to understand the issues. Gerard Mercator and John Dee both experimented with projections for the use of sailors and for the 'better' portrayal of the world as it newly emerged from the limited confines of Ptolemaic knowledge. Dee in particular in the 1570s was concerned about how to show and record routes in high latitudes from 60 degrees northward to assist in the discovery and recording of the northern passages to China and the East Indies, which Heylin so dismissively mentioned later. The obvious practical point here is that it is important to be able to record the routes you have found, if you want to follow them again and arrive successfully.
One of Dee's experiments was with a chart which he called the 'paradoxal' chart (Slide 12) because on a globe the representation of a line of constant direction (i.e. a rhumb) became a spiral on a flat map as you approach the very high latitudes towards the Pole. Dee first described what he called the 'paradoxal compass' in his 'General and Rare memorials' in 1576 and also provided what seem to be tables of longitude values (now lost) resulting from raising degrees and minutes of latitude as you sailed west or east on your particular compass bearing. The paradoxal chart was

called ‘paradoxal’ because it had spiral lines on it converging on the North Pole. These lines were in reality a straight course to be followed at sea and thus ‘paradoxal’. We know that Martin Frobisher carried several ‘charts with spiral lines’ on his first voyage to the North West Passage in 1576.

It has been assumed, however, that the ‘paradoxal’ chart was a circumpolar chart pure and simple. As the maritime historian D.W. Waters remarked ‘the paradoxal compass’ mentioned by John Davis ‘wears an aura of mystery.’ Only Dee and John Davis (*c.* 1550-1605) talk about it, which is not surprising as Davis was Dee’s pupil. In *The Seaman’s Secrets* (1594) Davis describes paradoxal line sailing, ‘Paradoxal Navigation, demonstrateth [on circumpolar charts] the true motion of the ship upon any corse assigned…. Neither circular nor straight, but concurred or winding….Therefore called paradoxal, because it is beyond opinion that such lines could be described by plane horizontal motion.’ They could only be truly described on a sphere, for example on a globe or on the earth itself.

In this book Davis promised to publish a paradoxal chart ‘with all convenient speed’ together with an explanation of its use on the grounds that ‘it will best serve the seaman’s purpose, **being an instrument portable (my emphasis)**, of easie stowage and small practise performing the practises of navigation as largely and as beneficially as the globe.’ In other words it was not a globe itself but was a chart-like portable instrument, which implies it had movable parts of some sort.

It is unclear who made it but it shows John Davis’s discoveries in the Davis Strait in 1587. Perhaps it is by the mathematician and physician Thomas Hood who is known to have made other vellum instruments with movable parts or by Davis himself. If you look carefully you can see the movable ruler whose tip is just over the circumference on the left hand side. The rule is graduated at 5 degree intervals from 20 to 90 degrees N of latitude. Pecked spiral lines or rhumbs emanate from the central rose at 0 degrees of longitude, which is given as the Azores (a prime meridian common at that time). The paradoxal chart must have been known at the time, as William Barlow in the *Navigator’s Supply* (1597) remarked sagely that ‘some terme [it] paradoxall…. Onely I say (paradoxall) is beside the purpose, and astonisheth with an emptie sound [ie doesn’t mean anything]: but spiral [the word which Barlow preferred to use] apperteineth directly to the matter, and declareth the true effence [i.e. effect] of the thing signified’.

This chart is in what is probably Sir Robert Dudley's collection of MS charts used for the *Arcano Del Mare* eventually published in 1647. In the *Arcano* Dudley, who had known Davis in England, speaks highly of him as an expert navigator. Davis is known to have drawn charts (e.g. one of the Magellan Strait on Thomas Cavendish's circumnavigation, 1589) but none signed by him are thought to exist. This particular chart *shows* the spiral lines and has a movable latitude rule attached to it by a moveable volvelle in the centre. It was formerly mounted on three hinged boards which would have been closed when not in use on board. The rule is graduated at 5 degree intervals from 20 to 90 degrees N. Pecked spiral lines or rhumbs emanate from the rose at 0 degrees longitude, which is given as the Azores (a prime meridian common at that time) and converge on the North Pole. The latitude rule could be moved to read off your intended course from your present position, already established by direction and distance sailed and/or by taking latitude observations of the stars and sun. It seems unlikely that the chart would have been used by itself since it is small-scale: it may have been used therefore with the usual plane chart. The latitude and longitude scales in minutes on the sides of the paradoxal chart could give the exact value of the increase in latitude and the same for the longitude values over a day's sailing which could then be transferred to the plane chart for actual navigation. The paradoxal chart for such latitudes does not seem to have been used to any great extent although equally ingenious 'spherical charts' were invented by the Dutch. The more common circumpolar chart remained the normal representation of the Arctic regions in Dutch atlases of the seventeenth century (Slide 13).

For sailing in less high latitudes the usual method of sailing was what was known as latitude sailing— that is running north or south until the latitude of the ship's destination was reached and then sailing east or west, depending on the known prevailing winds and currents. Although this is a gross oversimplification, it is easy to see how a plane chart, which divides latitudes North and South of the Equator into equal units of not normally less than 10', or a sixth of a degree, which at 20 leagues or 60 nautical miles to a degree could be used to find a position on either side of the Atlantic, at least adequately to within 1 to 2 leagues difference which approximates to three to six miles, at which point you sailed North or South along the coast to arrive at your destination. There was the problem of observing your latitude accurately and even more so for longitude which remained a problem with whatever map projection was used.

The sea charts and world maps at this period were therefore normally on this plane projection, as we saw in the earlier examples of the map of the Pacific in 1600. The possibility of using the Mercator projection first shown on Mercator's printed world map of 1569 was practically available from 1599, when the mathematician Edward Wright succeeded in explaining the mathematical basis for the Mercator charts in his *Certaine Errors of Navigation* (1599). But his work does not seem to have influenced the emerging chart- makers as he, and indeed the East India Company, would have liked. Mercator's projection makes the distance between lines of latitude increase proportionally the farther they are drawn from the Equator to give a true direction upon the chart for the ship to follow (Slide 14 and 15). With the exception of one world chart, this one probably by John Daniel (c. 1617), which looks like a chart on the Mercator projection and one possibly by Edward Wright himself of the Azores to Portsmouth (c. 1595) there are no others surviving drawn by the English using this projection at this date. Mercator charts of the Atlantic had been introduced by the Dutch hydrographer and publisher Willem Jansz. Blaeu as early as 1619. These were printed on vellum at small scale and these and other Mercator charts are known to have been on board Dutch East Indiamen.

Why was the take up so slow at least in England? William Barlow in the *Navigators Supply* (1597) stated that charts on the plane projection were the only ones in ordinary use with sailors. Of the Mercator charts he remarked that "this manner of Carde hath beene publiquely extant in print these thirtie yeares [i.e. since Mercator's map on the Mercator projection 1569] at least but a cloude (as it were) and thicke myste of ignorance doth keepe it hitherto concealed." He further asserted that "men of good knowledge" had done what they could "to disgrace it." In view of the scarcity of surviving charts using the Mercator projection, it is likely that the original view put forward by David Waters, that "the navigators of the chartered companies of the Jacobean era [1603–- 21] reveals that the chart projections they used were generally scientifically accurate ones, either circumpolar charts or charts on Mercator's projection" needs to be modified. All the more so if we take into account the somewhat damning views of the shipmasters themselves when they used the new Mercator charts. Walter Payton, for example, recorded in 1615 that the "Plats of Daniel (of Mercator's projection), prooved false about seventie leagues in distance of longitude betwixt the land of Æthiopa, Cape Bona Speranza [Cape of Good Hope],

and the Ile of Saint Laurence [Madagascar], as the same protracted into Plano of Tottens [i.e. Gabriel Tatton] making doe manifest." Anthony Hippon, on the Globe, which left London in February 1611 ([i.e. 1612 new style.)], complained from Bantam, Java on 25 May 1612 to the company about Daniel's chart. "Your worships shall understand ther ar certaine platts made by John Daniell dwellinge near the Iron gate [near the Tower of London] in which plats Cape Comorin and the wester part of Zelon are very falcely projected, for I dare avowe upon my life that Poynt de Gallia is within 10 minutes of 6 degrees, (latitude)." He went further and said that "I would advise your worships that charge is given unto all such mariners as ar entertained in your service not to buy any orf those erronious maps." These references prove that Daniel was making charts on Wright's or Mercator's projection for the Company's shipmasters, and we may infer, therefore, that he was probably instructed by Wright himself (there being no other likely candidate)), who was employed by the East India Company. However, the charts were evidently not acceptable to the Company's shipmasters. The Company's court minutes of March 1614 make clear that the Company wished "to tye him [Wright] to their service to peruse the Journalls of their people that shall retourne, whereby they shall gaine a double benefitt as well to cause their men to be more carefull and exact in their obseruacons [observations] and shall like wise reape the benefitt of them for the betteringe of the people knowledge in these partes. **Also to examine their maryners and p[er] fect their plotts**" (my emphasis). It is unclear that he ever did what was required; the court minutes of July 1614 record that the Governor and Deputy were "to putt him in rememberance thereof." From the same entry we learn that the Company had a number of journals and "letters of intelligence" in its hands and had it in mind to employ someone else to copy them into books of reference, and that he, Wright, was to be the person to compare the "Jornalls and plotts' wth such as have beene formerlie made by the Portingalls and others to distinguish the errors that were purposely or ignorantlie sett downe in them." As Wright died in 1615, it is hardly surprising that his improved form of chart on the Mercator or Wright projection was apparently little used: as he had little time to instruct the mariners after his appointment in 1614, and many remained unconvinced.

Richard Norwood in the Seaman's Practice (1637) writes in the dedication to the reader that "considering that this particular experiment was proposed above 30 yeares

since, by our Country man Mr. Edw.Wright, to invite some to the tryall of it, as a thing which he would have done himselfe, if he had found such furtherance and opportunity as he desired, which it seemes he did not nor any other since that time." He then goes on to say that reckonings of the ships way "are still kept upon the Plaine or Common Sea-chart, which makes a degree in any parallel equal to a degree in the Equinoctial [ie the on the Equator.]

The Mercator chart's construction and use seem to have caused real practical difficulties and misunderstandings. Wright had explained the mathematical principle and provided tables giving the value of the secant for every 10'of a degree of latitude from the equator to 80 N, but the difficulty of measuring the point east/west and north/south, at which you have arrived seems to have remained.

(See Slide 16 in attached list for diagram: the line called the secant is the side (B-C) of the right angled triangle opposite the angle A). If you knew your longitude position on your departure, for example, from Plymouth at point A, on a known line of longitude AC and the direction in which you had gone and the distance travelled on line AB, then because a right angled triangle has been formed between the line of longitude and the line of latitude you must have reached, you can find out what the length of the secant is by reading off the logarithmic value for it and thus the change in longitude/latitude you have made. Even with, for example, the use of the paradoxal chart described above, which may have been an attempt to provide an easy graphic way of reading off your course using the moveable rule, seems to have been too difficult for many to do.

In 1659, while still complaining of the neglect and want of the Mercator charts, Norwood then explained the reason why: that "you must often alter your Scale, because the degr. of Latit. on this Chart are not equall but grow greater and greater towards the Poles." The need therefore to calculate the distance north or south rather than read it off the scale bar, which was **not** composed of equal length units, was an added complication and not one the sailors wished to accommodate. We can understand why perhaps. In any case the absence of a sure way to calculate longitude made the position finding of any ship uncertain irrespective of the projection used.

In many cases, however, the practical problems of calculating the waxing latitude values as you travelled north or south on the Mercator projection from the Equator could be avoided quite safely. Speaking of plane sailing, Peter Perkins, Master at the Mathematical School at Christ's Hospital in 1679, stated, "Supposing the Earth and

Sea to be a plain flat, and each parallel equal to the Equator, yet by breaking a long Voyage into many short ones, a Voyage may pretty well be performed thereby, near the same meridian [I take this to meaning only a little east or west of a meridian (i.e. a line of longitude north to south]." He also asserted that the plane chart would "serve in the longest Voyages so a man return in or near the opposite Rumb [i.e. constant line of direction] he went by." While this was indeed the practical case there were some earlier acceptances of the projection.

A French example shown here from the Dieppe School of chart makers and cartographers possibly by Jean Gerard in 1625 shows a graphic way to determine how to record the distances travelled north. He gives in the top left corner of his 'Nouvelle Description Hydrogaphique' a scale bar which gives increasing distance values for latitudes up to 80 degrees north on a Mercator chart. Not until the 1630s did the Mercator charts, as explained by Wright, begin to have any effect in terms of oceanic use in England. Charles Salstonstall in a voyage to the West Indies in the 1630s, had a wager with the Dutch and English masters in the fleet that the plane chart that some were using would not be correct in keeping their reckoning and that those using the Mercator chart would get there first.

He won and triumphantly claimed that the "plaine chart, which you see apparently hath need of Crutches, being lame in all his Linements." Once the practical effect of arriving faster in the right place became demonstrable then presumably the old methods died out but very slowly dependent on the master's predilections.

Sir Robert Dudley compiled and published his sea atlas on the Mercator projection in 1646-7 and the debates that went on between him and his editor/engraver on the positions of places, can be seen in the MS drafts of the *Arcano* (1630s) and the final printed versions 1646 (slides 18, 19 and 20)

Even at the end of the seventeenth century not every seaman was convinced. Edmond Halley was still trying to persuade sailors of the merits of Mercator charts: he wrote to Pepys in despair in 1696, complaining of their obstinate use of the "common plaine chart as if the earth were a flat" and their "absurd way of keeping their reckonings by the plain chart."

The graphic revolution of Mercator's projection first seen in 1569 which altered the image of the world in print and thus in western European eyes down to the twentieth century, probably began to happen practically at sea somewhere around the 1630s on the Atlantic route and became standard somewhat later. While perhaps a beautiful

geometrical design, with a mathematical basis to allow it to be repeated once the mathematical formula was learnt; and especially apposite for describing the new coastlines of the oceans of the Atlantic and the Pacific in the new world maps, it did not satisfy the practitioners' practical purposes at sea. It was too difficult. For following routes and for position finding the chart had a battle on its hands from the practitioners. Thus it languished, until the education and training of the practitioners could meet its requirements and it then became standard.

This proposition leads on to the third lecture on what drove the clients and the users to use maps and charts and thus drove the cartographic activity internally and externally. How did cartography manifest itself in England and the rest of maritime Europe through its publishers, distributors, patrons and users in the mid to late seventeenth centuries?