Navigating culture: navigational instruments as cultural artefacts, c. 1550-1650

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RESEARCH NOTE

Navigating culture: navigational instruments as cultural artefacts, c. 1550–1650

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This research note explores the possibility of approaching navigational instruments not as evidence of the progress of scientific knowledge, but of the experiences of early modern seafarers. These instruments formed an important part of the material culture of seafaring, existing as physical elements of the mental framework through which mariners understood both the natural and the human world around them. Some of these cultural contexts can be reconstructed through evidence such as navigational literature, ships' journals, maritime court records, and seafarers' wills. Instruments and navigation were associated explicitly with the wider activity of shipping, with all its economic and political potential, as well as with the new developments in early modern science, and the perception of the natural world as a site of divine providential intervention. While basic navigational skills contributed to a shared culture amongst seafarers, instruments were also status symbols, conferring authority, signifying competence at sea and representing not only expertise but the sorts of behaviour considered appropriate for a shipmaster.

Keywords: navigation; instruments; material culture; seafarers; authority

The progress of navigational knowledge during the early modern period, a time of European maritime expansion in which navigation played a key role, has received a good deal of attention from historians of science, and the significant technical developments have been charted in great detail.[1] More recently, following scholarly studies of the social and cultural dimensions of practical mathematics,[2] over the last decade historians have begun to consider the commercial and political implications of navigation, the relationship between navigation and mathematics, and the existence of a 'navigational culture', a phrase used but not fully explored by Katherine Neal.[3] Similarly, A.J. Turner has argued that 'the history of instruments . . . can only be written accurately and intelligibly if account is taken of contexts beyond the merely scientific';[4] navigational instruments were thus not only technical objects but also a central element of navigational culture. They therefore provide us with material evidence of the mental framework through which the seafarers of the early modern period perceived and understood their own society and its relationship to the world around them.

To approach these items as cultural artefacts, however, certainly presents difficulties. Navigational instruments are, in the analytical terminology for material culture set out by Jules Prown, 'devices', functional objects designed for a specific, practical purpose, not the communication of cultural values.[5] Many of the objects that survive from this period are presentation pieces, such as the ivory cross-staff and backstaff produced by Thomas Tuttell

in 1700,[6] which can demonstrate the general form of an instrument but are not representative of those actually used by seafarers (see Figure 1). Moreover, as Robert Hicks has argued, instruments as they are preserved now in museums are 'decontextualised', removed from the mental frameworks in which they would originally have possessed meaning.[7] Yet Hicks's work has demonstrated that it is possible to reconstruct some of the contexts surrounding navigational instruments, though care must of course be taken not to read too much into the available evidence.

This note presents the findings of a research internship aiming to recover some of the cultural meanings of navigational instruments, held at the National Maritime Museum, Greenwich, in July 2009, with a focus on instruments in the museum's collection and on English sources. It will briefly discuss the historical evidence available, before considering two significant aspects of navigational instruments: the 'meanings' of navigation, the general cultural associations with which navigational instruments were connected; and the 'authority' of navigation, the role navigational instruments played as status-objects within the maritime community. These are only two of many, and much more research could be done to explore early modern navigational culture. The conclusion will suggest a few promising lines of enquiry.

I

The natural place to begin such research is with the objects themselves but, as 'devices', navigational instruments tend to be relatively incommunicative in terms of the social and cultural connotations they carried for their makers, owners and users. Many of these objects seem devoid of ornamentation which might hint at cultural meaning. Some decorated items do survive, examples at Greenwich including an hour-glass adorned with small wooden crosses, a nocturnal with a heart-shape design on its handle, and a pair of compass-dividers engraved with the name of their owner, but it is difficult to extrapolate general cultural conventions from these isolated examples (see Figure 2).[8] Significant exceptions to this are both manuscript and printed charts, categorised by early modern writers as a kind of instrument.[9] The social and cultural dimensions of these objects have received more interest from historians than other instruments, particularly in reference to the growth of a 'Thames school' of manuscript chart-makers, associated with the Drapers' Company, in the sixteenth and seventeenth centuries.[10]

It is tempting to find, in illustrated cartouches or the depiction of the seascape, revelations of the mindset of early modern seafarers, but these objects must be treated with

caution because they might rather encapsulate the thoughts of cartographers and engravers, or reflect the processes of production. For example, chart-maker John Seller published a sea atlas based on copper plates he had bought in Holland, which were themselves made for a counterfeit edition of Willem Blaeu's *Het licht der zeevaert*; exactly whose culture these charts express is therefore a complicated issue.[11] Nevertheless, because charts were often intended for sale to seafarers, it is probable that their design would have been market orientated and would therefore utilise tropes familiar to their intended audience, meaning that these objects cannot be discounted entirely.

To rediscover the cultural contexts of instruments besides charts, however, it is necessary to move beyond the physical objects themselves to the written material concerning early modern navigation. Most important is the increasingly numerous navigational literature published during this period: technical manuals, printed sea-charts and sailing directions, which are, like the instruments, primarily technical but contain hints of cultural ideas, especially in prefaces addressed to the intended audience. While these books form a relatively small proportion of the vast increase in printed literature during this period, the continuous reprinting of popular works over a long period, and the sale of these works at specific sites such as St Magnus's churchyard at the north end of London Bridge, suggest that they were produced to meet a specific and continuous demand.[12] Also useful are journals of voyages, both manuscript ships' logs and printed narratives, and there are other, more oblique sources, such as the wills of mariners and the papers of maritime law courts, which occasionally contain references to the navigational culture familiar to many early modern seafarers. By collating the evidence found in these sources with our understanding of the instruments themselves, we can build up a partial but revealing picture of what navigational instruments meant for those who made, possessed and used them.

II

The term 'navigation' in the early modern period did not mean only the system of knowledge by which ships were guided at sea, although this appears to have been the word's primary usage. 'Navigation' could also refer to the actual physical movement of a vessel: Captain William Peyton kept a journal of 'euery seuerall dayes nauigation . . . in this my seconde voyadge to East India'.[13] In a more general manner, 'navigation' described shipping and trade, and it is in this sense that it appears in various statutes of this period for the 'continuance' or 'encouragement' of navigation.[14] 'Navigation' was thus almost a quantifiable entity which was considered an issue of national importance by some

navigational writers,[15] although others claimed that their work was 'for the common good of all Maisters, Pilots and seamen whatsoever',[16] appealing to the concept of an international maritime community. Because both private and naval ships engaged in warfare, navigation was also closely linked with military activity, and this is reflected in a cartouche on one of the charts printed in The light of navigation, a translation of *Het licht de zeevaert*, where navigational instruments are depicted alongside armour and weapons.[17] Navigation may also have taken on a particular political relevance during the early seventeenth century when claims to 'sovereignty' over the sea became a controversial issue between European rulers and legal theorists.[18]

It was these associations which made the science or art of navigation (the terms appear to have been interchangeable) so important, a significance that was recognised at the time. John Davis, an explorer, navigational writer and designer of instruments, wrote that navigation was 'the meane whereby Countryes are discovered, and communitie drawne between Nation and Nation, [and] the word of God published'.[19] While later twentieth-century historians of European expansion acknowledged the role navigation played,[20] apart from a few important exceptions it has been largely overlooked in recent overviews of 'Atlantic world' history.[21] Yet, as Davis's words demonstrate, it was explicitly linked with trends which this scholarly paradigm emphasises as characteristic of the early modern period – the connection of diverse and distant places, the negotiation and development of interconnected identities, and the imposition and exchange of social, cultural and religious ideas.

Within this broader meaning of 'navigation', the technical element of early modern navigation was crucial to the cultural meanings of navigational instruments. The instruments necessary to oceanic navigation – listed by Davis as the cross-staff, compass and chart[22] – do appear to have been consciously considered as new and important technological developments. Navigators were dependent, according to one Dutch writer and former pilot, on 'the artificial aid of many a hidden, strange and almost supernatural devise (sic)'.[23] 'Artificial' is used here with the contemporary meaning of 'achieved by artifice'; Richard Polter, one of the four Principal Masters in Elizabeth I's navy, and Master of Trinity House, wrote that if a 'Maister be not artificiall . . . these courses [i.e. navigation] be to[o] deepe for his understanding, and therefore hee [is] not worthie to take charge at all'.[24] Instruments therefore represented not only the technological advances of the early modern period, particularly in mathematics, but also the necessarily direct engagement with these developments by navigators, and their importance to maritime activity more generally.

The description of instruments as 'almost supernatural' reveals how navigation figured into contemporary understanding of the natural world and its processes, which was for many people in this period informed by religious beliefs about direct divine intervention.[25] The workings of magnetic compasses in particular were considered miraculous, and the lodestone was thought to possess 'secrete virtues given of GOD to that stone for mans necessarie use'.[26] Robert Norwood, a navigator and surveyor who also wrote a spiritual autobiography expressing deeply held religious convictions, thought that the compass was the most important '[a]mongst all the Mysteries which God hath of late years discovered to the World for the furtherance of Navigation', the ultimate purpose of which was, according to Norwood, to spread the evangelising Christian message.[27]

Astronomical instruments, such as astrolabes, cross- and backstaffs, may have possessed another religious connotation because they brought navigators into contact with the early modern conception of the cosmos, depicted in diagrams in navigational literature as a series of concentric circles with the earth at the centre and the divine or spiritual world outside the physical (see Figure 3).[28] The location of the 'heavens' literally in or beyond the sky suggests the intriguing possibility that astronomical observation could be associated with prayer: it is tempting to interpret in this way Captain Luke Foxe's comment that, during his voyage in 1631 to seek the Northwest Passage, he only 'set my sight towards the skie . . . when I either call'd to God, or made Celestiall obseruation'.[29] However, this may be no more than a dig at his genteel rival, Thomas James, who took lunar observations while searching for the Northwest Passage in the same year.[30] Although some navigational instruments possessed religious associations, therefore, more work is needed to understand the extent and nature of the links between navigation, religious belief and perceptions of the natural world.

III

The simplest elements of navigation were common to all seafarers, as the technical language of navigation was part of the general seafaring jargon which demonstrated belonging to the maritime community.[31] Young boys were taught the points of the compass when they began their lives as mariners; if they could successfully 'say their Compasse', they were apparently rewarded with 'a quarter can, and a bisket of bread'.[32] Many of these skills would have been sufficient for coastal or short voyages, and the contrast between 'pilots' and 'navigators' may have been overdrawn by some writers; early modern navigation is perhaps better conceived as a continuum of knowledge encompassing all of these activities.[33] Nevertheless, within this there was a distinction between these simpler techniques and more complex instruments, and

the correct knowledge and use of navigational instruments, possibly even just possessing them, functioned as markers of maritime experience and social authority. These were especially significant qualities because authority on board ship, with the possible exception of naval vessels, was not based on the same hierarchies of landownership which predominated in most of early modern society, although that is not to say that wealth and social status were unimportant.[34]

This distinction between instruments is most clearly illustrated in *The light of navigation*, the frontispiece of which depicts a roughly dressed, unshaven mariner holding a lead line, contrasted with a finely attired navigator bearing a cross-staff, suggesting that the ability to use specific instruments was associated with higher social status (see Figure 4 [this image is not available on the NMM website]).[35] It is, admittedly, difficult to be certain about how accurate this depiction is. The appellation 'common', given both to astrolabes (also called 'mariners' rings') and cross-staffs,[36] implies that they were relatively well-known objects within the maritime community, and some have been recovered from shipwrecks, indicative of a certain ubiquity.[37] On the other hand, only very few mariners' wills specifically mention instruments, suggesting that only a minority possessed them, and that these objects, and the 'seabooks' often bequeathed with them, were valuable enough to be left as particular gifts.[38] However, the contrast between wills from the 1550s–60s, examined by P.E.H. Hair and J.D. Alsop, with very detailed lists of instruments, and the much more cursory references in wills during the seventeenth century, perhaps suggests that these objects became more commonplace throughout this period.[39] It is possible, then, that navigational instruments were an increasingly familiar sight to most seafarers, but that only those of higher status could afford to actually possess them.

Indeed, it appears that the use of astronomical instruments was an important part of the stereotype of the 'painfull [i.e. painstaking] seaman' who would make a competent shipmaster, and was connected with the behavioural standards which justified a master's authority on board ship.[40] William Bourne, one of the earliest English writers on navigation, described a good master as 'sober and wise . . . one as can well gouerne himselfe . . . [and] keepe his company in awe of him', as well as having 'knowledge in plats or cardes, and also in such instruments, as be meete to take the heighth (sic) of the Sunne or any Starre'.[41] Such was the association of navigational ability with the use of instruments that George Waymouth, like Davis an explorer and designer of instruments, wrote that 'good instrumentes make a good navigator, without the which it is impossible for him to doo any good in performance of any profitable voyage at sea',[42] and Charles Saltonstall, another

navigator and writer, described 'the Practick part' of navigation as 'properly placed upon the making and using of divers Instruments'.[43]

These writers naturally had an interest in advertising the subject of their own treatises, but there is other evidence supporting their statements. An intriguing endorsement of the authority of navigation, and especially the role of instruments, survives in a letter from Lucy Downing to her brother John Winthrop, the governor of New England during the early seventeenth century. Although the full facts are not entirely clear, it appears that Lucy's son had been apprenticed to a recently deceased shipmaster, and in the letter Lucy complains that her husband had contracted with the master's widow to continue the apprenticeship in conditions 'disaduantagious' to their child. She assumes her husband must have

> suppose[d] the art of nauigation to be so easly attayned, wich those that are artists in that art doe denye, and that without help in the rulles as well as by practis, it can neuer be attained to be more than a comman seaman, wich is noe better than commane slauerye.

In her request for help from Winthrop, she refers to a similar case 'betwixt one mr higinsones sonn and mrs pirce', in which, though Higinsone was legally bound to complete his apprenticeship to Mrs Pirce after his master's death, 'he denyed to serue her'. The New England magistrates acquitted him because 'he proued a seaman was not suffitient *till he could make his own Instruments*', which she was unable to teach him.[44] This indicates the existence of a demarcated standard of knowledge and capability, intrinsically connected with the production and use of navigational instruments.

This attitude meant that the possession of instruments might be used by unscrupulous individuals to gain command of ships. Bourne complained of 'some that take charge, [who] will haue instruments & other things thereunto apperteyning, & yet they the[m]selves do not know the use of the[m] . . . yet they will seme to by cunning'.[45] Willem Blaeu likewise described those

> who goe out of the waie with their Instruments, as Cross-staves, Astrolabium and Compasses, and will not suffer the common saylers to see their work. This by some is done upon pride and unwillingness, because they would keepe the art and knowledge onely to themselves, and by some because they understand not their proceedings wel, and therefore are in feare to be shamed.[46]

At the same time, there is some evidence that navigational teaching was a regular occurrence. John Skay, a navigational writer who claimed to have taught 'the poorer sort gratis', advised 'the ignorant and honest Seaman' to combine 'those things thy Master doth teach thee at sea

. . . [with] the practise of the things taught in [my] booke'.[47] . . . [with] the practise of the things taught in [my] booke'. Curiously, the ability to navigate was not restricted to master mariners: ship's carpenter John Cluer related that he had 'in some measure studied the art of navigation, and doubts not of his owne abilitie to carry or saile a shippe', though he confessed 'hee would not adventure the same' and he seems to be an exceptional case.[48] exceptional case. Even if such teaching was common, it was well known that knowledge was power. Thomas James, for his 1631 voyage, chose for his crew only men who were unable to navigate, 'keeping thus the Power in my own Hands, I had all the Men to acknowledge immediate Dependence upon my self alone . . . as well of the Navigation, as of all other things'.[49]

IV

During the early modern period navigational instruments were, as they remain today, emblematic of the maritime world and the culture of seafaring: John Seller sold his sea atlases at the sign of the mariner's compass in Wapping.[50] These objects primarily fulfilled a practical function, but were also enmeshed in the matrix of social, political and religious concepts by which seafarers made sense of their world. Because every long-distance voyage, and possibly also many shorter ones, depended with all their consequences upon the correct use of these instruments, they had a powerful political resonance, symbolic of military power and economic potential. In a religious context, they reflected the contemporary understanding of the natural world as continually influenced by divine intervention. Socially, the use and possession of these objects provided a way to demonstrate authority, to prove the capability of a navigator to exercise command over their crew, even if this could also be abused.

More research is required fully to understand these and other aspects of navigational instruments as cultural artefacts. Most importantly, it is necessary to expand the scope of study, either in terms of evidence, chronologically, or geographically. Some sources were excluded from this study because of time constraints, among them Hakluyt's *Principal navigations* and the voluminous records of the East India Company, but a wide range of sources from other authors – autobiographies, discovery narratives, contemporary poetry or drama – could also be consulted.[51] Considering a longer timeframe might make it possible to trace significant changes, while a comparative study investigating the interconnections and contrasts between sources in different languages, or the navigational practices of different European regions, could highlight both universal concepts and specific peculiarities. The encounters between Europeans and other navigators, for example in Asia or the Pacific

Ocean, would also be a fascinating topic. There is still much to be learnt about navigating culture.

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Notes

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[1] For an excellent overview of the literature in numerous languages, see Mörzer-Bruyns, 'Research in the history of navigation'. The most significant for this period, in English, are Waters, *The art of navigation in England*; Stimson and Daniel, *The cross-staff*; Waters, *English navigation books*; Forty, 'Sources of latitude error' and 'The backstaff and the determination of latitude'; Bennett, *The divided circle*; Mörzer-Bruyns, *The cross-staff and Sextants at Greenwich.*

[2] Johnston, 'Mathematical practitioners and instruments'; Hankins and Silverman, *Instruments and the imagination*; Hill, '"Juglers or Schollers?" '.

[3] R.D. Hicks, 'The ideology of maritime museums', some elements of which have been published in his *Voyage to Jamestown*; Glover, 'The navigation of the Nonsuch'; Neal, 'Mathematics and empire'; Rose, 'Mathematics and the art of navigation'. Wallis, 'Navigators and mathematical practitioners', is a slightly earlier example of work on the later seventeenth century, though it says little about navigators except those involved in royal-backed voyages of discovery.

[4] Turner, 'Interpreting the history of scientific instruments', 26.

[5] Prown, 'Mind in matter', 14–15.

[6] N[ational]M[aritime]M[usuem] NAV0040 and NAV0505. See Higton, 'Tuttell, Thomas'.

[7] R.D. Hicks, 'Ideology of maritime museums'.

[8] NMM AST0080; AST0128; NAV0517.

[9] Blundeville, *M. Blundeville*, fos 314v, 329v; Saltonstall, *The navigator*, 57.

[10] Campbell, 'The Drapers' Company'; Thrower, ed., *The compleat plattmaker*. For a general overview, see Waters, 'English pilot' and, for the later period, Robinson, 'Evolution of the English nautical chart'.

[11] Coolie Verner, 'John Seller and the chart trade in seventeenth century England' in Thrower, ed., *The compleat plattmaker*, 139–40.

[12] For example, William Bourne's *Regiment for the sea* was reproduced in ten editions between 1574 and 1631 (Rose, 'Mathematics and the art of navigation', 177, 182). On St Magnus church, see Plomer, 'The church of St Magnus'; books sold at St Magnus, many of them in recurring editions, include Cortés, *The arte of navigation*; Anthonisz, *The safeguard of saylers*; Aspley, *Speculum nauticum*; and Saltonstall, *The navigator*.

[13] B[ritish] L[ibrary] Add. MS 19,276.

[14] Examples include James I, *By the king*; by the Commonwealth government, *An act for the increase of shipping*; Charles II, *An act for the encouraging & increasing of shipping*, and Charles II, *A proclamation concerning the acts of navigation*.

[15] Bourne, *A regiment for the sea*, sig. A3r; Blundeville, *M. Blundeville*, sig. A4v. George Waymouth decided not to print his manuscript treatise, 'The Jewell of Artes', for fear that it would be carried to 'forraigne nations' (BL Add. MS 19,889, fo 4r; see also 18r).
[16] Polter, *Path-way to perfect sayling*, frontispiece; see also Anthonisz, *Safeguard of saylers* (page references to 1656 edition), sig. A2r–v; Saltonstall, *The navigator*, sig. A4r.
[17] Blaeu, *Light of navigation*, chart 9, 'Pascaarte van een deel der Zeecusten van Gallißen en[de] van Portugal', between 64–5.
[18] For the disputes in the early seventeenth century over the 'sovereignty of the seas', the most complete but now outdated work from the English perspective is Fulton, *Sovereignty of the sea*. For the theoretical aspects of this dispute, see Vieira, 'Mare liberum vs mare clausum'; Thornton, 'Hugo Grotius'; and Thornton 'John Selden's response'. Less attention has been paid to William Welwood's contribution to the debate, *De dominio maris*: see Alsop, 'William Welwood'.
[19] Davis, *Seamans secrets*, sig. A3v–4r; for Davis see M. Hicks, 'Davis [Davys], John'.
[20] Hale, *Renaissance exploration*; Parry, *Discovery of the sea* and *Age of reconnaissance*; Andrews,
Trade, plunder, and settlement.
[21] For these exceptions, see Seed, 'Navigating the mid-Atlantic', which uses oceanographic techniques to reconstruct early Portuguese navigation; and the generally technical accounts in Chaplin, 'The Atlantic Ocean'; and Rodger, 'Atlantic seafaring'. Other recent overviews include Armitage and Braddick, eds, *The British Atlantic world*; Pietschmann, ed., *Atlantic history*; and Bailyn and Denault, eds, *Soundings in Atlantic history*.
[22] Davis, *Seamans secrets*, sig. B1v.
[23] Waghaenaer, *Mariners mirror*, fo. 3v; on Waghaenaer's early career, see Waters, 'The English pilot', 342.
[24] Polter, *Path-way to perfect sayling*, sig. F3r; see also Stevin, *Haven-finding art*, sig. B1r.
[25] On this theme generally, see Walsham, *Providence in early modern England*.
[26] Blundeville, *M. Blundeville*, fo 333v. For examples of compasses, see NMM NAV0276, NAV0463.
[27] Norwood, *Sea-mans practice*, sig. A2v, 106; Norwood's autobiography ('Confessions') is published in *Grace abounding*. See also Bendall, 'Norwood, Richard (1590–1675), surveyor and mathematician', in *ODNB*.
[28] Cortés, *Arte of navigation*, fo 4r; Skay, *A friend to navigation*, fo 1v. Examples of these instruments include astrolabes: NMM NAV0022, NAV0029, NAV0030; cross-staffs: NAV0510, NAV1973; backstaffs: NAV0031, NAV0036, NAV0037, NAV0045, NAV1974, NAV1975, NAV1976. Many of these cross- and backstaffs date from the early eighteenth century, as a few have only parts remaining from the earlier period.
[29] L. Foxe, *North-west Fox*, 222–3.
[30] James, *Strange and dangerous voyage*.
[31] A. Fox, *Oral and literate culture in England*, 28–30, 94–5.
[32] Saltonstall, *The navigator*, 13–14; Smith, *An accidence or the path-way to experience*, 4.
[33] This idea was a key theme in Waters, *Art of navigation*, but has been challenged by Rose in 'Mathematics and the art of navigation', 182.
[34] The issues of authority within the maritime community, and the community's relationship to wider society, are discussed in more depth in Blakemore, 'London maritime community', and in my forthcoming Ph.D. thesis.
[35] Blaeu, *Light of navigation*, frontispiece. See also Hendrick van der Borcht, 'A Navigator with Globe and Dividers', NMM BHC3132, a painting depicting a fairly well-dressed figure.

[36] Bourne, *Regiment for the sea*, fos 7r, 26v; Blundeville, *M. Blundeville*, fo 322r.
[37] Price and Muckelroy, 'The *Kennemerland* site', 210; NMM NAV0022 and NAV0029.
[38] For examples of bequests from the early seventeenth century, see T[he] N[ational] A[rchives], PROB11/155, will of William Parmeter, proved 15 Jan. 1628[/9]; PROB 11/159, will of Robert Browne, proved 7 Jan. 1630[/1]; PROB 11/162, will of Peter Milbourne, proved 12 Dec. 1632; PROB 11/170, will of William Parker, proved 15 Feb. 1635[/6]; PROB 11/173, will of Nicholas Francklyn, proved 27 Feb. 1636[/7]; PROB 11/176, will of Robert Harte, proved 16 Feb. 1637[/8]; PROB11/177, will of Robert Couldam, proved 13 June 1638; PROB 11/179, will of Symon Hitchcock, proved 19 Apr. 1639; and PROB 11/181, George Hawker, proved 15 Oct. 1639.
[39] Hair and Alsop, *English seamen and traders in Guinea*, 132, 214–16, 324–6.
[40] Anthonisz, *Safeguard of saylers*, sig. A2v–3r; Davis, *Seamans secrets*, sig. A3v–4r; Foxe, *North-west*
Fox, sig. A1v.
[41] Bourne, *Regiment for the sea*, fo 7r.
[42] BL Add. MS 19,889, fo 18r; for Waymouth see Ransome, 'Waymouth [Weymouth], George'.
[43] Saltonstall, *The navigator*, 2, 5–9. For Saltonstall, see Le Fevre, 'Saltonstall, Charles'.
[44] Forbes, ed., *Winthrop papers*, 296–7. My emphasis.
[45] Bourne, *Regiment for the sea*, fo 58r.
[46] Blaeu, *Light of navigation*, sig. E3v.
[47] Skay, *Friend to navigation*, sig. A2v–3v, 33.
[48] TNA PRO HCA 13/61, deposition of John Cluer, 8 Mar. 1648[/9].
[49] James, *Strange and dangerous voyage*, 4.
[50] Helen M. Wallis, 'Geographie is Better than Divinitie. Maps, Globes, and Geography in the Days of Samuel Pepys', in *The compleat plattmaker*, ed. Thrower, 17–18.
[51] Hakluyt, *The principal navigations*; for recent work on Hakluyt, see Fuller, 'Writing the long distance voyage'; Sacks, 'Discourses of western planning'; Sacks, 'Rebuilding Solomon's temple'; and Jowitt, 'The uses of "piracy"'. On the East India Company collections, see Moir, *General guide*, and Farrington, *Catalogue of East India Company*.

References

Primary sources – objects

All objects held at the National Maritime Museum, Greenwich.
AST0080 – hour glass, c. 1630.
AST0128 – nocturnal, seventeenth century.
BHC3132 – Hendrick van der Borcht, 'A Navigator with Globe and Dividers'.
NAV0022 – mariner's astrolabe, c. 1588.
NAV0029 – mariner's astrolabe, c. 1600.
NAV0030 – mariner's astrolabe, 1550–1600.
NAV0031 – backstaff, c. 1720.
NAV0036 – backstaff, 1720.
NAV0037 – backstaff, c. 1720.
NAV0040 – backstaff, c. 1700.
NAV0045 – backstaff, c. 1700.
NAV0276 – mariner's compass, c. 1570.

NAV0463 – mariner's compass, c. 1650.
NAV0505 – cross-staff, c. 1700.
NAV0510 – incomplete cross-staff, 1703 or earlier.
NAV0517 – dividers, c. 1649.
NAV1973 – part of a cross-staff vane, 1703 or earlier.
NAV1974 – backstaff sighting vane, 1703 or earlier.
NAV1975 – part of a wooden sight or shadow vane, 1703 or earlier.
NAV1976 – part of a horizon vane, 1703 or earlier.

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Additional MS 19,276 – journal of Captain William Peyton, 1615–17.
Additional MS 19,889 – George Waymouth, 'The Jewell of Artes', no date.

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HCA 13/61 – examinations in the High Court of Admiralty, 1647–9.
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