Challenging Tropes: Genius, Heroic Invention, and the Longitude Problem in the Museum

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Abstract: This essay explores how concerns relevant to academic historians of science do and do not translate to the museum setting. It takes as a case study a 2014 exhibition on the story of longitude, with which the author was involved. This theme presented opportunities and challenges for sharing nuanced accounts of science, technology, and innovation. Audience expectation, available objects, the requirements of display, and economic constraints were all factors that could impede effective communication of the preferred version of the story, developed in part through an associated research project. Careful choices regarding objects and design, together with the use of theatrical and multimedia spaces and digital displays, helped to shift visitor interest from the well-known version of the story and toward a longer and more peopled account. However, the persistence of heroic and genius narratives meant that this could not always be achieved and that effective engagement must include direct conversation.

My title can be read in two ways. On the one hand, curators and historians of science often seek to challenge the recurring and simplistic interpretations of the past that emphasize heroic individuals, discoveries, and inventions. On the other, these tropes are challenging to deal with in a museum setting. They are desired by audiences, exploited by marketing teams, and have a persistent emotional appeal that curators must acknowledge and choose to work with, work against, or carefully subvert. They can risk annoying other experts if they accept the heroics too wholeheartedly or alienating audiences if they ignore the "hook" that persuades visitors to part with money. The same is true for popular writing, of course, which was the subject of some angst for historians of science in the 1990s and 2000s, when it felt as if others were not only profiting from "our" subject but doing so in a way that undermined the discipline's sense of what was worth knowing.[1] This essay considers such issues from the museum perspec-

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[1] David Philip Miller, "The 'Sobel Effect': The Amazing Tale of How Multitudes of Popular Writers Pinched All the Best Stories in the History of Science and Became Rich and Famous While Historians Languished in Accustomed Poverty and Obscurity, and How This Transformed the World . . .," *Metascience*, 2002, *11*:185–200. See also John Hedley Brooke, "Presidential Address: Does the History of Science Have a Future?" *British Journal for the History of Science*, 1999, 32:1–20; Simon Schaffer, "Our Trusty Friend the Watch," *London Review of Books*, 31 Oct. 1996, *18*(21):11–12; and John Gascoigne, "'Getting a Fix': The *Longitude* Phenomenon," *Isis*, 2007, 98:769–778.

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tive, where it is not just a question of persuading the public but also of suiting institutional values and objectives and working with the opportunities and constraints of object display. The case study is a 2014 exhibition on the very topic that prompted the millennial angst: the story of longitude.

Ships, Clocks, and Stars: The Quest for Longitude (hereafter *SCS*) was a major international exhibition at the National Maritime Museum, Greenwich, between 11 July 2014 and 4 January 2015. It used 750 square meters of the temporary exhibition space's 800 square meters and displayed 190 objects (including two replicas), largely from the museum's own collections but also loaned from elsewhere, alongside interactive, graphic, and scenic interpretation, often evoking historic spaces.[2] As the exhibition team members were well aware, there was some tension between our desired narrative and the popular version of the story centered on John Harrison's development of marine timekeepers, which gained wide recognition with Dava Sobel's 1995 bestseller *Longitude*.[3] Here I outline some of the thinking behind the exhibition, exploring approaches and strategies designed to engage visitors with a narrative more complex and peopled than they may have expected. I will also discuss problems encountered, which relate particularly to the practicalities of using objects and to questions of audience expectation. The exhibition was well received by historians of science (including winning a prize from the British Society for the History of Science), but it is less clear whether lay audiences came away with the desired messages. Academics who aim to share research with wider publics through object display and partnerships with museums should be aware of the possibilities and limitations involved in the necessarily multidisciplinary, pragmatic, and compromise-filled process of developing galleries and exhibitions.[4]

SHIPS, CLOCKS, AND STARS AT GREENWICH

The institutional setting of the *SCS* exhibition inevitably influenced its nature. Historic scientific artifacts are found within the collections of a wide range of museums, and, as the various essays in this Focus section make clear, their meaning and role vary correspondingly.[5] Royal Museums Greenwich, comprising the National Maritime Museum (NMM), the Royal Observatory Greenwich (ROG), the Queen's House, and the *Cutty Sark*, combines aspects of a history museum, science museum, art gallery, and tourist attraction, along with the historic interest of its various sites. Its collections range from fine and decorative arts to boats, guns, uniforms, and scientific instruments. Mounting a historically based and research-informed science exhibition, supported by a wide range of different types of historic artifact and aimed

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[2] Royal Museums Greenwich, *Ships, Clocks, and Stars: The Quest for Longitude*, http://www.rmg.co.uk/see-do/exhibitions-events/past/ships-clocks-stars (accessed 2 Dec. 2016). Eighty-seven objects (including five replicas and nine facsimiles or props) subsequently toured, going to the Folger Library in Washington, D.C.; Mystic Seaport in Connecticut; and the Australian Maritime Museum in Sydney. Visitor numbers were 94,994 in Greenwich; across all four sites, visitor numbers were 241,737. Some of the design and interactive elements can be seen in images of the exhibition at Rebekah Higgitt, "Ships, Clocks, and Stars: A New Exhibition—In Pictures," *Guardian*, 10 July 2014, https://www.theguardian.com/science/the-h-word/gallery/2014/jul/10/ships-clocks-stars-exhibition-in-pictures.

[3] The core exhibition team consisted of Richard Dunn (Senior Curator and Curator of Navigation), Rebekah Higgitt (Curator of History of Science), exhibition curators Kris Martin and Claire Warrior, and project manager Matthew Lawrence.

[4] See also Sharon Macdonald, *Behind the Science at the Science Museum* (Oxford: Berg, 2002), a thorough ethnographic analysis of the complexities and contested nature of exhibition making.

[5] For an interesting comparison of different display contexts see Alison Boyle, "'Not for Their Beauty': Instruments and Narratives at the Science Museum, London," in *Scientific Instruments on Display*, ed. Silke Ackermann, Richard L. Kremer, and Mara Miniati (Leiden: Brill, 2014), pp. 37–60; Richard Dunn, "'More Artistic than Scientific': Exhibiting Instruments as Decorative Arts in the Victoria and Albert Museum," *ibid.*, pp. 61–76; and Ackermann, "'Of Sufficient Interest . . ., but not of Such Value . . .': 260 Years of Displaying Scientific Instruments in the British Museum," *ibid.*, pp. 77–93.

chiefly at an adult audience, was perhaps more likely here than in an institution more exclusively focused on science.

The exhibition was very satisfactorily supported by the museum's collections and location, but specific hooks were required to justify a large-scale temporary exhibition, given that aspects of the story have a constant presence in displays at the ROG. The key hook was that 2014 marked three hundred years since the passing of the first Longitude Act and the appointment of the Commissioners (later Board) of Longitude. The expectation of public interest in the story, which also attracted United Technologies as a sponsor, was important, although our market research indicated that people did not necessarily recall Sobel's book. We were also using new research, from an NMM/University of Cambridge project funded by the U.K.'s Arts and Humanities Research Council (AHRC).[6] This project, which fed into and helped justify the thinking of the curators, signposts the recent enthusiasm of British research councils for funding projects involving institutional collaboration and public engagement. University–museum collaborations have been particularly key for the AHRC, also underpinning their Collaborative Doctoral Awards and Partnerships schemes. This has been welcomed by curators and academics, perhaps especially in the history of science, but, despite much intellectual common ground, has revealed different agendas and ways of working.

Ludmilla Jordanova has recently discussed such differences in relation to heroic narratives of invention and discovery, noting the potential for "a culture-clash between public discourse and scholarship."[7] She acknowledges the lack of easy solutions: museums need both nuanced research *and* stories that have the recognition and emotional appeal to bring in visitors. The question is then whether it is possible to use such hooks to draw audiences to an exhibition that is more complex and questioning than they expect. Ultimately, Jordanova's answer is for both academics and curators to accept the importance of audience connection with stories and people and for museums to be seen as a place of debate where the very appeal of heroes can be discussed. This points to the importance of museums as participatory environments and to the role of surrounding programming—tours, talks, discussions, and other events—but necessarily limits the numbers reached. By and large this essay focuses on the exhibition experience, while acknowledging that it is easier to control or give nuance to the message with face-to-face engagement and that it is difficult to know what most visitors will make of and take away from the objects, displays, or exhibitions that they encounter.

THE PROBLEMATIC NARRATIVE

The problems with Sobel's account from the point of view of academic history of science have been well rehearsed. As David Philip Miller puts it, the message is "that science is the product of individual genius, that scientific discovery is an heroic process, and that science leads to technology, has impacts and transforms the world."[8] Such stories create romantic tales of struggle and rivalry, of goodies and baddies, of challenge and success. Thus, the story of longitude became one about how the correct and transformational answer to a desperate problem that had baffled the scientific elite was found by an ingenious outsider, who beat them in the race to the prize: in spite of prejudice and unfair treatment, Harrison's innate genius and heroic

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[6] "The Board of Longitude, 1714–1828: Science, Innovation, and Empire in the Georgian World" project (2010–2015) was led by Simon Schaffer, with Dunn and Higgitt as Co-Investigators, two postdoctoral researchers (Alexi Baker and Nicky Reeves), and three Ph.D. students (Katy Barrett, Eoin Philips, and Sophie Waring).

[7] Ludmilla Jordanova, "On Heroism," *Science Museum Group Journal*, 2014, *1*, http://dx.doi.org/10.15180/140107 (accessed 2 Dec. 2016).

[8] Miller, "'Sobel Effect'" (cit. n. 1), p. 189.

persistence eventually saw him rewarded and his invention go into lifesaving action. This account clashes with the historical record and with what we know about the processes of science and technological innovation in multiple ways. While elites undoubtedly exclude(d) others from social, institutional, and financial rewards, the vigor with which underdog heroes (see also Robert Hooke, Stephen Gray, Alfred Russel Wallace, and Ada Lovelace) are championed often leads to serious distortions, relying as such accounts do on individualistic and competitive notions of invention and discovery. Harrison was neither a lone inventor nor shunned by elites in the Board of Longitude: he was given unprecedented financial support, up to and even during the period at which their relationship broke down.

Looking for a winner, the usual version of the story also dismisses the role of astronomy as a longitude method, presenting it as old-fashioned and wrongheaded in comparison to the forward-looking chronometric solution. In fact, the timekeeping and astronomical methods matured at the same time and, rather than being rival solutions competing for a prize or for adoption, were used complementarily; moreover, both received support.[9] Even if the focus is exclusively on timekeeping, it was not a case of Harrison coming up with the unexpectedly right answer because he was an outsider: others had developed marine timekeepers previously and were to continue developing these and Harrison's ideas before affordable and practical timekeepers could be used at sea. In addition, neither of the new techniques replaced long-used methods of navigation, including dead reckoning, or made a dramatic difference to the safety of mariners. Long term, their impact was in relation to quicker and more predictable voyages and the increased scope and accuracy of maritime charts.

The simplistic narrative has wider significance that makes it important for museums to shift the public debate. Above all is the question of science and technological innovation as individual versus collective endeavor. Also unrealistic is the belief that discovery or invention leads swiftly to application and use, when they usually require time and financial support—often, before there is commercial value, from government.[10] Uptake is usually slow and piecemeal, advantages may not be clear or real, and even apparently superior innovations are not necessarily successful.[11] It takes investment in training, standardization, subsidy, and infrastructure to encourage change. While heroic narratives are often justified as ways to create enthusiasm and support for science, they may be counterproductive.[12] Increased interest in science and related careers, and support for government funding, requires awareness that science needs all sorts of people and skills, not just lone mavericks, and that innovation is slow, contingent, and,

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[9] See, e.g., David Philip Miller, "Longitude Networks on Land and Sea: The East India Company and Longitude Measurement 'in the Wild,' 1770–1840," in *Navigational Enterprises in Europe and Its Empires, 1730–1850*, ed. Richard Dunn and Rebekah Higgitt (London: Palgrave Macmillan, 2015), pp. 223–247; and Dunn and Higgitt, *Finding Longitude: How Ships, Clocks, and Stars Helped Solve the Longitude Problem* (Glasgow: Collins, 2014).

[10] In the contemporary context see Mariana Mazzucato, *The Entrepreneurial State* (London: Demos, 2011).

[11] A canonical example is Ruth Schwartz Cowan, "How the Refrigerator Got Its Hum," in *The Social Shaping of Technology*, ed. Donald A. MacKenzie and Judy Wajcman (Buckingham: Open Univ. Press, 1985), pp. 202–218.

[12] Critiques have followed the popular success of heroic stories. See, e.g., Marjorie Garber, "Our Genius Problem," *Atlantic*, 2002, http://www.theatlantic.com/magazine/archive/2002/12/our-genius-problem/308435/ (accessed 2 Dec. 2016); and Christine MacLeod, "The Invention of Heroes," *Nature*, 2009, *460*:572–573. Recent research suggests that, while tales of effort and difficulty can be pedagogically useful, those that simply emphasize exceptional ability are not. See Xiaodong Lin-Siegler *et al.*, "Even Einstein Struggled: Effects of Learning about Great Scientists' Struggles on High School Students' Motivation to Learn Science," *Journal of Educational Psychology*, 2016, *108*:314–328. It would be interesting to test accounts of lesser lights and of different types of effort (e.g., hardworking vs. heroically dedicated). There has also been some pushback: see, e.g., Roger Highfield, "Heroes of Science," Royal Society lecture, 2012; and Highfield, "The Decline of the Scientific Hero," *Edge*, 2012, https://www.edge.org/response-detail/23686 (accessed 2 Dec. 2016).

if not at the mercy of markets and individuals, requires governmental or institutional policy and support.

Making a virtue of the problems of the well-known and heroic version of a story could lead to a myth-busting approach. To an extent, *SCS* aimed to do this for those who were familiar with Sobel's book, but it could not be the primary approach. Rather, as part of reconfiguring the narrative, we took aim at some "myths"—lone geniuses and world-changing inventions—that may be universal enough to count as general expectations. However, given what we know about audience habits in terms of dwell time and reading, and the persistence of popular narratives, it can fairly be asked to what extent we could expect visitors to shift their views on the specific story or its wider application.[13] In the museum context there were also other elements working against this, including the differing appeal of relevant objects. We made use of a range of strategies to address such issues, enjoying successes but not always overcoming associated problems.

SOLUTIONS AND BARRIERS

The exhibition did four big things in order to challenge heroic and individualistic accounts. First, it used a longer time scale and, second, it contained a larger number of people than might be expected. Third, it presented the development of the astronomical and timekeeping methods as parallel and complementary. Fourth, it used nonobject elements (interactive and audiovisual displays, graphics, and immersive spaces) to generate interest in alternative parts of the story. In the guise of narrative, personalities, and places, we explored such unappealing themes as stimuli, development, prototypes, government support, bureaucracy, infrastructure, trials, commercial development, and use. The exhibition began with pre-eighteenth-century navigation and the backstory to the plausible options in 1714. We were keen that none were dismissed as "nutty" but were seen as possible pragmatic and local solutions.[14] Reaching the 1730s–1760s, the story slowed and narrowed to focus on the London context that sustained development and set the scene for trials and support by the Royal Society, the Board of Longitude, the ROG, and the Royal Navy, including on James Cook's voyages of exploration. Thereafter, we showed how manufacturing was simplified or mechanized, training implemented, and the key instruments made affordable. We ended in the nineteenth century, with the new techniques being used to create charts, against which all navigational methods became more reliable.

No Lone Geniuses: Adding People to the Story

The exhibition's large cast, spread across time, emphasized the collaborative nature and slow development of longitude solutions. Sixteen contemporary portraits helped to convey the human-made nature of science and acted as visual clues to their historic worlds.[15] The first set put the faces of "champions" to the potential methods: Galileo Galilei, who discovered Jupiter's moons and promoted them as a longitude solution; Christiaan Huygens, whose pendulum clocks helped revolutionize astronomy and whose marine timekeepers inspired others; John Flamsteed, the first Astronomer Royal at the ROG, founded to perfect the lunar-distance

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[13] See Lynda Kelly, "Writing Text and Labels," http://australianmuseum.net.au/writing-text-and-labels (accessed 5 Jan. 2017), for a useful summary of literature on visitor behavior, including low dwell time and label reading, and how to change it. On museums, collective memory, and "distortion" of interpretation due to lack of congruity between expectation and exhibit see Susan A. Crane, "Memory, Distortion, and History in the Museum," *History and Theory*, 1997, 36:44–63.

[14] Owen Gingerich, "Cranks and Opportunists: 'Nutty' Solutions to the Longitude Problem," in *The Quest for Longitude*, ed. William J. H. Andrewes (Cambridge, Mass.: Harvard Univ., Collection of Historical Scientific Instruments, 1996), pp. 134–148.

[15] On the exhibition's portraits see Katy Barrett and Richard Dunn, "A Mechanic Art," *Apollo*, 2014, pp. 82–86.

method; Edmond Halley, who mapped magnetic patterns at sea; and William Whiston, who was the prime lobbyist behind the Longitude Act and worked on several possible solutions, including rocket signals. The next tranche of portraits were linked to the Board of Longitude and the Royal Society: Isaac Newton, who advised Parliament on the Longitude Act; George Graham, clockmaker and supporter of Harrison; Harrison himself; Astronomers Royal James Bradley and Nevil Maskelyne; and John Hadley, who developed the octant. The section on use of the methods at sea included a portrait of Cook, while those of Thomas Mudge, John Arnold, Thomas Earnshaw, and Jesse Ramsden presided over the section on the later development of timekeepers and instrument manufacture.

Big names helped demonstrate what a significant and perennial problem longitude was and show the collaborative nature of the response. However, there were risks. One was the possibility of creating a timeline of "giants" and, in challenging one hero story, drawing on several more. This was a fair criticism of a dramatic marketing film made to promote the exhibition, with its "enumeration of the 'greatest minds,' placing Harrison in a line with Galileo Galilei and Isaac Newton," although the exhibition aimed to reveal different types of contribution.[16] What is undeniable is that, after the early sections, the story is almost entirely about white British men. Using objects made it considerably harder to point out the international nature of the story in the exhibition than in the accompanying book. Object numbers must be limited for reasons of space, narrative clarity, and cost, and using local collections means that national stories dominate. We had, for example, hoped to borrow one of Pierre Le Roy's remarkable timekeepers from the Musée des Arts et Métiers, but they do not, ironically, travel. The cost of borrowing the particular timekeeper by Ferdinand Berthoud that was offered instead could not be justified by its significance. Ultimately, our non-British objects and interpretation included a seventeenth-century globe by Blaeu, showing that the world was already being explored and mapped; material relating to Galileo, Huygens, and Tobias Mayer; mere mention of the crucial French work on lunar theory and tables; and a small display that could hardly do justice to the richness of French horology. Visitors would have been forgiven for thinking that this was a British story.

The exhibition did display objects brought back from Cook's voyages, showing how testing longitude technologies tied into the collection of data, artifacts, and specimens in the Pacific. But making use of ethnographic objects raised the danger that the people encountered on these voyages were presented as objects of investigation rather than as individuals with agency. We were, however, able to borrow a map drawn by Cook with the help of the Polynesian priest and navigator Tupaia.[17] In addition to serving as an important reminder of other successful navigation systems—and the specificities of the Western scientific tradition—this nicely showed that local knowledge remained essential even to those who made successful use of new technologies. In this case, thinking about the use of instruments and innovations as co-constructed by makers and users within specific contexts and locations briefly allowed another voice and view of the world to enter the exhibition. This is similar to the approach used in the Science Museum's recently opened Information Age gallery, which mixes the distinctly white, male

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[16] Ulrike Zimmermann, "John Harrison and the Heroics of Longitude," *helden. heroes. héros*, 2014, 2, https://www.sfb948.uni-freiburg.de/e-journal/ausgaben/022014/helden_heroes_heros_2_2_2014_zimmermann.pdf (accessed 2 Dec. 2016). The emphasis of the film and exhibition poster on shipwreck, storm, and risk was not approved by the curators. The opening space did use these elements, but an animated seascape was designed to show lack of reference on a calm day as much as the perils of storms, while a shipwreck painting pointed out the danger of uncharted rocks rather than the perils of not knowing your longitude.

[17] Chart of the Society Islands (1769), Add. MS. 21593, British Library, London.

story of invention with stories of use and development that include, for example, Cameroonian mobile networks and women telephone exchange operators.[18]

On the question of the representation of women, Tilly Blyth, the lead curator of Information Age, writes, "It would be tokenistic and ahistorical to present women as playing a major role in the creation of early communication technologies . . . because women had little access to the education, capital and resources available to male inventors and scientists." Yet, as Jordanova states, "presenting individuals with whom visitors can identify is essential." Blyth's tactic of looking at how machines and technologies "were used, adopted and integrated into society, changing social relations in the process," is surely the right one to help reach a varied public and to counter essentially masculine accounts of heroes and geniuses.[19] When discussing use of technologies at sea in the eighteenth century, however, it is again a male world. This must be explained by reference to the (problematic) standards of the time, noting how things have and have not changed; but shifts in narrative can usefully reveal other contributions. Thus, despite lacking a portrait or appealing objects, we used a large graphic and text board to include Mary Edwards as a linchpin within the network of computers employed by the Board of Longitude to produce the *Nautical Almanac*.[20] Here, an important story of governmental and institutional support of innovation also demonstrated the essential role of less well-known individuals, including Edwards and her daughters.

Our interest in wider social and institutional settings justified the inclusion of four more women. One was Queen Anne. While hardly a key player, she and her consort, who was Lord High Admiral, symbolized Britain's ambitions for nation and navy, around which the impulse to develop longitude solutions was shaped. A portrait of both beside the 1714 Longitude Act to which she gave royal assent was appropriate. In thinking about the context of public science, within which interest in longitude was fostered, we aimed to convey the social, literary, and visual culture of the period.[21] One section evoked a coffeehouse with imagery and a soundscape that drew on eighteenth-century prints and commentary, including a female voice, and displayed schemes for longitude projects and satirical responses. A publication by Jane Squire was included on the exhibition tour but, in a sad reminder of pragmatic realities, was too large for the available showcase in Greenwich.[22] Another space represented was the ROG, where both successful methods were tested and supported. Since we were "on site," we could explore the observatory as a home as well as a place of work, showing how space was used and displaying Sophia Maskelyne's dress beside her husband's "observing suit." Finally, the John Arnold portrait includes his wife and son, conveying an image of prosperous industry and middle-class values that shows the commercial success and family nature of his business.

There were other, unknown women we could not display, who help challenge the lone genius myth directly. Harrison, the carpenter who began with wooden clocks, was remarkable and innovative, but he came to London for a reason: it gave him access to the skills and materials that he needed to develop his business. We should not forget that he had a workshop with apprentices and that he drew on the skills of pieceworkers who made parts such as springs;

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[18] Tilly Blyth, "Information Age? The Challenges of Displaying Information and Communication Technologies," *Sci. Mus. Group J.*, 2015, 3, http://dx.doi.org/10.15180/150303.

[19] *Ibid.*; and Jordanova, "On Heroism" (cit. n. 7). See also MacLeod, "Invention of Heroes" (cit. n. 12).

[20] See Mary Croarken, "Providing Longitude for All: The Eighteenth-Century Computers of the *Nautical Almanac*," *Journal of Maritime Research*, 2002, 4:106–126.

[21] We were particularly inspired by Larry Stewart's "Longitudinarians," in *The Rise of Public Science: Rhetoric, Technology, and Natural Philosophy in Newtonian Britain, 1660–1750* (Cambridge: Cambridge Univ. Press, 1992); and Katy Barrett, "The Wanton Line: Hogarth and the Public Life of Longitude" (Ph.D. diss., Univ. Cambridge, 2013).

[22] See Alexi Baker, "Jane Squire," *Oxford Dictionary of National Biography* (2015).

they were often women. Referring to this, Simon Schaffer has written of the importance of such "lesser-known narratives of the fascinating and complex milieu in which the machines were designed and built." He compares heroic stories and star objects in museums with the "charismatic megafauna" (pandas, polar bears, tigers) that draw public interest to conservation efforts on behalf of "less alluring beings at least as crucial and fragile."[23] By putting Harrison's beguiling clocks into the exhibition, and inevitably recalling heroic accounts, we attempted something similar for the other people in the exhibition.

Balancing Objects and Stories

Yet the Harrison clocks also worked against us. I have previously called them "the most charismatic of objects," having guided visitors around them and read Sobel's concluding paragraphs: "Coming face-to-face with these machines at last . . . reduced me to tears. I wandered among them for hours." She described the motion of H1 and, despite the fact that it went to sea only once, found that it "came to life not only as the true time but also as a ship at sea, sailing mile after nautical mile." So dominating are the clocks that, in Flamsteed House at the ROG, they easily overwhelm stories of the Astronomers Royal who lived there. Indeed, one *SCS* focus group participant referred to the building as "Harrison's House." The visually exciting timekeepers are immediately associated with their maker (we could imagine Harrison's brain depicted as whirring clockwork) and seem comprehensible in their purpose, even if complex in their mechanism. Against them, objects associated with the development of the lunar-distance method—astronomical tables, mathematical calculations, octants, and sextants—are a hard sell. We had to work to find ways to balance the two stories, by doing what we could both to generate interest in the astronomy side and—a rare choice for curators—to decrease the dominance of our star objects. As Ulrike Zimmermann noted, the clocks were "not quite as central as one might have expected."[24]

In fact, they were, literally, sidelined. When displayed at the ROG, the four Harrison timekeepers have individual cases and can be viewed in the round. In the exhibition, the three large timekeepers were in a single case, placed against a wall. The visitor met them not as a culmination of the story but in the fourth of nine spaces. Using design to maintain the idea of parallel development, we placed the clocks so that they faced objects relating to astronomy. Placed symmetrically at the end of the section were the contemporaneous "prototypes" for both methods, with Harrison's sea watch on one side and John Bird's large sextant and Maskleyne's published lunar-distance tables on the other. Our hope was to balance interest, but we were not fully successful—on busy days a queue for the timekeepers' case developed, rather than visitors making more of emptier spaces. We partly rectified the lack of appeal of objects on the astronomy side by including touchable sextants. In my fantasy money-no-object exhibition, we had a moving platform, usable instruments, and objects to observe, but the realities of durability and cost meant that they were fixed and less of a draw than we hoped. More successfully, we enhanced an element that equated the two methods, which could otherwise only be supported by manuscript volumes. Making a virtue of the lack of objects, and enlivening a bureaucratic story, a space empty apart from a table and chairs was filled with an animated

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[23] Simon Schaffer, "Chronometers, Charts, Charisma: On Histories of Longitude," *Sci. Mus. Group J.*, 2014, 2, http://dx.doi.org/10.15180/140203 (accessed 2 Dec. 2016).

[24] Rebekah Higgitt, "Revisiting and Revising Maskelyne's Reputation," in *Maskelyne: Astronomer Royal*, ed. Higgitt (London: Hale, 2014), pp. 7–49, on p. 43; Dava Sobel, *Longitude: The True Story of a Lone Genius Who Solved the Greatest Scientific Problem of His Time* (1995; London: Fourth Estate, 1998), pp. 174–175; and Zimmermann, "John Harrison and the Heroics of Longitude" (cit. n. 16).

table-top projection and audio track that conjured up the Board of Longitude's 1763–1764 sea trials, which tested innovations in both timekeeping and astronomical methods and placed the visitor in the 1765 meeting that discussed their results.

Elsewhere we made use of the draw of "people stories" to balance the narrative. One of the difficulties for the lunar-distance story is that, while timekeeping appears to have one clear hero, astronomy obviously involved many people, divided among theory, land- and sea-based observation, calculation, and instrument making. Thus, within this large cast, we selected a local champion for the astronomy story, pairing the portrait of Harrison with one of Maskelyne. This choice was also provoked by Sobel's presentation of the latter as a "villain," a concept just as unhelpful as that of "hero."[25] A review of the exhibition in the *New York Times* spotlighted another "less famous" individual as "a major figure in this exhibition."[26] This was the watchmaker Larcum Kendall, who was charged by the Board of Longitude with making a copy of H4. His copy, which went on Cook's second circumnavigation, and two subsequent sea watches, which aimed to simplify the mechanism, were all on show. The objects—impressively lined up—generated interest and were further enhanced with a digital interactive display. Using object "biographies," this presentation allowed visitors to track each timekeeper's movements on a series of voyages. Thus we showed their long history of use and repair, as well as contextualizing their invention and manufacture. Such questions of use, slow take-up, and retention made a brief reappearance toward the end of the exhibition, where we showed the ongoing production of instruments designed to improve old or alternative solutions.[27] Mere invention, we suggested, does not immediately or universally solve a problem.

CONCLUSION

As Sam Alberti wrote in the 2005 Focus section on "Museums and the History of Science," "However didactic and interpreted an exhibition, responses [are] a combination of that which was elicited by the display and that which came from within the visitor—things remembered and felt."[28] Because of the complexity of the story, we used an authoritative museum voice rather than something more multivocal, engaged, or participative. Labels and text panels made careful use of language to avoid the slippages that tend to simplify the story. Harrison did not invent "the chronometer," and so the words "timekeeper," "clock," and "watch" were used in sections before the appearance of John Arnold, who coined the term. Likewise, the Board of Longitude did not offer a "prize" for which methods and individuals "competed" in a "race." We therefore wrote of its various "rewards," using a timeline over Harrison's clocks to show that their making had been supported by a series of payments over many years before they (and lunar distances) were trialled with a view to receiving one of the large rewards (£10,000–£20,000). We likewise avoided the designers' initial idea of representing a literal sea race between the different potential solutions.

However, the title of the *New York Times* review—"The Race That Changed the World and Made the Watch"—shows the durability of the heroic narrative. This framework is so strong that the reviewer apparently barely noticed our account of astronomy. I suspect that

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[25] See Higgitt, *Maskelyne*. Interest in Maskelyne was also sparked by the bicentenary of his death in 2011 and the NMM's 2010 acquisition of a significant group of Maskelyne objects and books.

[26] Roderick Conway Morris, "The Race That Changed the World and Made the Watch," *New York Times*, 2 Sept. 2014, http://www.nytimes.com/2014/09/03/fashion/the-race-that-changed-the-world-and-made-the-watch.html (accessed 2 Dec. 2016).

[27] See David Edgerton, *The Shock of the Old: Technology and Global History since 1900* (Oxford: Oxford Univ. Press, 2011). On object biography as "an appealing narrative hook" and in research see Samuel J. M. M. Alberti, "Objects and the Museum," *Isis*, 2005, 96:559–571, on pp. 560–561.

[28] Alberti, "Objects and the Museum," p. 569.

many visitors arriving with preexisting knowledge of Harrison, or perhaps having come across media coverage of the 2014 Longitude Prize, had the same experience.[29] Other reviews and comments showed that core messages could be grasped, but where displays are complex and nuanced, visitors are often unequipped to respond without the intervention of human guides.[30] Within the unmediated exhibition—among objects that may not be given more than cursory inspection and texts that may not be read—visitors will look for and respond to what is expected, rather than what is there, and to what attracts them visually. Even if they took on new ideas about the nature of innovation, there is no guarantee that visitors to *SCS* would think to apply them to other or modern contexts. Modern and historic science are typically presented differently, and human, contingent, political, and messy aspects are more readily allowed into historic accounts than into the cleaner presentations of current science.[31] We ensured that *SCS* contained the ingredients to allow a reshaped discourse about longitude and innovation. However, such discussion requires engaged audiences, who read associated publications, take curator-led tours or attend events, and probably cannot rely on exhibition alone.

[29] The Longitude Prize was launched by the innovation charity Nesta in 2014, and the exhibition featured its invitation to the public to vote for one of five possible challenges. While Nesta's thinking was nuanced, the media campaign was not; see comments in Seb Falk, "Review of 'Ships, Clocks, and Stars: The Quest for Longitude,'" *Sci. Mus. Group J.*, 2014, 2, http://dx.doi.org/10.15180/140204 (accessed 2 Dec. 2016).

[30] A reviewer on a watchmaker's website gratifyingly noted his new realization that timekeepers and lunar distances developed simultaneously: Nick Toyas, "Review: 'Ships, Clocks, Stars,'" https://www.christopherward.co.uk/blog/review-ships-clocks-stars/ (accessed 11 Jan. 2017). On the need for guides to help prompt suitable visitor responses see Jim Bennett, "Museums and the History of Science: Practitioner's Postscript," *Isis*, *96*:602–608, esp. p. 608. See also Bennett, "Can Science Museums Take History Seriously?" in *The Politics of Display: Museums, Science, Culture*, ed. Sharon Macdonald (London: Routledge, 1998), pp. 173–182.

[31] This difference is stark when comparing science museums and science centers but also appears within institutions. See, e.g., Boyle, "'Not for Their Beauty'" (cit. n. 5), p. 54, which describes the Science Museum as "akin to two different institutions." See also Rebekah Higgitt, "The Royal Observatory Greenwich and Its Publics, Past and Present," in *Astronomy and Its Instruments before and after Galileo*, ed. Luisa Pigatto and Valeria Zanini (Padua: CLEUP, 2010), pp. 439–450.