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The Tides Of Time: Temporality And Science In The British Atlantic

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The Tides of Time: Temporality and Science in the British Atlantic

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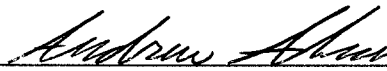

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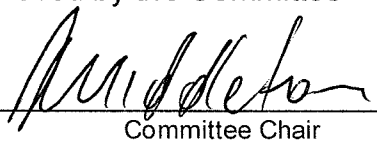

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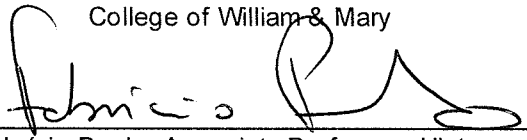

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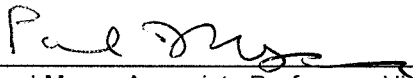

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ABSTRACT

Merchant Time and the Horological Revolution in Charleston, 1740-1770

The importance of mechanical timekeeping in consolidating Britain's Atlantic commercial system grew precipitously between 1740 and 1770. Nowhere was this development more pronounced than in Charleston, South Carolina. This community of watchmakers and merchants was, by the end of the period, selling a broad array of timepieces for an ever-expanding set of timekeeping needs and wants. This paper places their advertisements alongside the enactment of timekeeping legislation within Charleston and the correspondences of Henry Laurens, to reveal middle decades of the eighteenth century as a crucial moment in the formation of a new sense of time articulated towards merchant capitalism.

Reckoning with Empire: The Board of Longitude in the Eighteenth Century

This paper seeks to recast Britain's Board of Longitude as an instrument of empire building in the years following 1763. While the Board's initial mandate was understood as a narrow set of navigational and technical questions regarding how to reckon a ship's longitude at sea, the necessities of empire could no longer be ignored as the size and scope of Britain's Atlantic empire grew during the mid-eighteenth century. By reading the subtle shifts in language employed by commissioners in their deliberations and resolutions, I show how the Board of Longitude actively sought to refashion itself to meet the navigational demands of the British Empire.

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ACKNOWLEDGEMENTS

I would first like to thank the incredible community of colleagues, mentors, and loved ones who helped make this portfolio possible. My advisor, Dr. Simon Middleton, was extremely generous in his support of my research into Charleston's watchmaking community. Dr. Fabrício Prado was likewise a constant source of encouragement as I plumbed the depths of Britain's Board of Longitude. My fellow graduate students have fostered a strong and collaborative environment without which this portfolio could not have been possible. Lastly, I would like to thank the archivists at the Museum of Early Southern Decorative Arts and the Cambridge University Library whose digitization projects made this research possible.

This portfolio is dedicated to my parents, for their affection and support, and to Madeline, who has shown endless care, encouragement, and love throughout this entire journey.

Intellectual Biography

The two papers presented here represent some early explorations into role that mechanical timekeeping played in structuring the British Atlantic in the eighteenth century. The first, “Merchant Time and the Horological Revolution in Charleston, 1740-1770,” is an attempt to sketch out how the outdated concept of merchant time might be revived as a way to explore the interplay of clock- and solar-based timekeeping practices that was on display in colonial Charleston. Crucial to this, I argue, was the considerable increase in the number of clocks and watches that were imported from Britain in the middle of the eighteenth century.

This period, and the 1760s more specifically, were at the temporal heart of the second paper, “Reckoning with Empire: The Board of Longitude in the Eighteenth Century”. John Harrison’s attempt to solve the problem of longitude at sea and Britain’s imperial reforms after the Seven Year’s War felt connected in my mind. Study the Board of Longitude in its own right not only allowed me to see how these two were connected, but additionally filled the gap in an historiography which has tended to sideline the Board’s importance. These papers combined have allowed me to explore different angles to the history of time and timekeeping that will hopefully serve me well going forward in my studies.

The idea for the first paper came to me when I was looking into watch and clock advertisements in colonial newspapers. I soon discovered that Charleston had a disproportionately high number of individuals offering watches and repairs. The vast majority of watches in the colonies were made in Britain, specifically in the villages

surrounding Liverpool, so I then decided to look into the customs records for British exports. Once again, I found that Charleston was one of the premier destinations for watches within the empire, particularly in the latter half of the eighteenth century. My initial plan for the paper was to connect the development of merchant time in Charleston to the rise of outwork watch production in England. While I found some evidence that pointed to outwork and greater watch exports, Professor Middleton and I ultimately felt that I would not be able to fully flesh that out alongside the advertisement analysis I had planned for Charleston. That is still something I hope to explore further on in my studies, but for now it will have to wait.

The second paper was largely my attempt to restart a project I had first conceived of when completing my master's at the University of New Hampshire. The idea that the longitude was related to post-1763 reforms just felt intuitively correct, but at the time I had no way of articulating how. That project eventually turned into a study of the 1764 Sugar Act, but I knew I wanted to return to Harrison and the longitude question at some point. The Atlantic World research seminar with Professor Prado afforded me such an opportunity, and I ran with it. What I found when I took the time to go through the Board of Longitude minutes session by session was that there was no direct 'smoking gun' which tied the longitude question to imperial administration. Such evidence was there, but it required familiarizing myself with the history late-Newtonian popular science. This project was definitely more difficult to structure in terms of its time scale. The core argument concerns shifting discourses of 'utility' and 'practicability' during the 1760s, but I felt compelled to write a far longer backstory to that given how obscure the Board of Longitude was. I am not sure this is a topic that I plan to revisit

specifically. While I do think the Board to some degree, this project taught me that this sort of institutional history is not the sort that I am interested in really pursuing.

The source bases for these papers were quite different, and I am grateful for the experience that working with them provided me. Relying on digital archives forced me to think more creatively about how to read and mine them. This challenged me to rethink my initial approaches, methods, and conclusions, and I think that both papers are stronger because of those difficulties.

At the end of the day, I am proud of the work I have put into these papers. Writing them helped to shape my interests in time and timekeeper as well as to sharpen the methodologies and broader historiographies that I hope to contribute to in the future. More importantly, they taught me that good scholarship comes through struggle; be it with sources, argumentative structures, or the writing process itself.

Merchant Time and the Horological Revolution in Charleston, 1740-1770

Between roughly 1740 and 1770, the importance of mechanical timekeeping in consolidating Britain's Atlantic commercial system grew precipitously. Widely unaffordable and inaccurate at the turn of the century, watches were, by the 1760s, indispensable markers of time and status. Adam Smith was doubtlessly exaggerating in his speculation that watch prices had fallen from 20 pounds to 20 shillings since the mid-seventeenth century, but he was nevertheless correct in noticing the revolution that had occurred in watchmaking.[1] The rise of a complex out-work system, stretching from Liverpool to London, had facilitated a drastic increase in production such that watches were more widely available and affordable than ever. The horological solution to finding longitude at sea, regarded by Isaac Newton as an impossibility in 1714, was proven feasible by John Harrison in 1762.[2] While it was a peculiarity of London that in 1703 one could joke of never needing a wife or watch, "one may have a whore, and see what it is [o' clock], at the end of every street," public and private timekeepers were essential components of structuring daily life across the empire by the middle of the century.[3]

Nowhere was this development more pronounced than in Charleston, the urban hegemon of a South Carolina economy which came to represent the single largest

[1] Adam Smith, *An Inquiry into the Wealth of Nations*, (New York, 1982), p. 560. For exaggeration in Smith see: Morgan Kelly, Cormac Ó Gráda, "Adam Smith, Watch Prices, and the Industrial Revolution,"*The Quarterly Journal of Economics*, 131, no. 4, (2016), p.1727-52.

[2] For what is still the best account of the British state's desire to solve the issue of longitude at sea, John Harrison's marine chronometers, and Issac Newton's influence over the Board of Longitude, see: Larry Stewart, *The Rise of Public Science: Rhetoric, Technology, and Natural Philosophy in Newtonian Britain, 1660-1750*, (Cambridge, 1992).

[3] "The Levellers: A Dialogue between two young Ladies, concerning Matrimony, proposing an Act for Enforcing Marriage, for the Equality of Matches, and Taxing single Persons... (1703)", in, *The Harleian miscellany: or, A collection of scarce, curious, and entertaining pamphlets and tracts, as well in manuscripts as in print, found in the late Earl of Oxford's library*…v.XII, (London, 1811), p.197.

colonial market for watches in the British Atlantic. Between the late seventeenth and mid-eighteenth centuries, close to two-thirds of all clock- and watchmakers in the southern colonies were located in South Carolina.[4] Born out of a repair-work economy, this community of watchmakers and merchants was, by the end of the period, selling a broad array of timepieces for an ever-expanding set of timekeeping needs and wants. Through a reading of their advertisements, the enactment of timekeeping legislation within Charleston, and the correspondences of noted rice and slave merchant Henry Laurens, the middle decades of the eighteenth century are revealed as a crucial moment in the articulation of merchant time.

The concept of merchant time was first developed by Jacques Le Goff in 1960 to explain how medieval merchants resolved the conceptual tensions between their religious convictions and profit-seeking activities.[5] Put simply, if God controlled time and the merchant's livelihood was made through the mortgaging of time via bills of exchange and negotiable instruments, then the Christian trader needed a simultaneously secular temporality through which he could ensure both profit and salvation. Le Goff's ultimate concern was that historians need to take seriously the possibility of their actors moving through seemingly contradictory temporalities with apparent ease, and that "the various times within Time" be subjected to "an exhaustive investigation."[6]

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[4] Mark M. Smith, *Mastered by the Clock: Time, Slavery, and Freedom in the American South*, (Chapel Hill, 1997), p.26.

[5] Le Goff's discussion of merchant time first appeared in "Au Moyen Age: Temps de l'Eglise et Temps Du Marchand." *Annales. Histoire, Sciences Sociales* 15, no. 3 (1960): 417–33. The paper was first translated into English by Christophe Campos in 1970 and was published as "Church time and merchant time in the Middle Ages," in *Social Science Information*, 9, no. 4 (1970): 151-167. It would be another decade before Le Goff's paper reached a wider audience, when it was included in a translated volume of Le Goff's essays, *Time, Work, & Culture in the Middle Ages*, trans. Arthur Goldhammer, (Chicago, 1980).

[6] Jacques Le Goff, *Time, Work, & Culture in the Middle Ages*, (1980), p.38.

Le Goff's conception of merchant time proper has received comparatively little attention among historians of temporality due in large part to the work of E.P. Thompson. In a seminal paper from 1967, Thompson argued that in the late-eighteenth and early-nineteenth centuries, as English workers were driven from fields to factories, their experience of time and labor shifted from a 'task-orientation' to a 'time-orientation'. Whereas rural agricultural labor was marked by irregularity and concern with completing tasks, industrial production demanded that workers internalize the time of factory clocks and waged hours.[7]

More than 50 years on, Thompson's thesis has undergone significant revision in light of both empirical refutations theoretical critiques.[8] Through Barbara Adam's pioneering work on the multiplicity of "timescapes," historians now recognize the myriad of class-based, gendered, and racial structures which have complicated prior notions of a uniformly linear sense of "homogeneous, empty time."[9] Moreover, the once believed

[7] E. P. Thompson, "Time, Work-Discipline, and Industrial Capitalism," *Past & Present*, no. 38 (1967): 56–97.

[8] For a summary of empirical critiques, see: Glennie, Paul, and Nigel Thrift, "Reworking E. P. Thompson's `Time, Work-Discipline and Industrial Capitalism'." *Time & Society* 5, no. 3 (October 1996): 275–99. Glennie and Thrift's *Shaping the Day: A History of Timekeeping in England and Wales 1300-1800*, (Oxford, 2011), draws on theoretic insights in postmodern geography to complicate the relationship between the presence of timekeepers and the internalization of clock time. Feminist theorists and historians have further complicated Thompson's work by pointing to women's own temporal systems and labor patterns which Thompson ignored through his insistence on factory production as the impetus for clock time's hegemonic rise. For an overview of this work, see: Carmen Leccardi, "Rethinking Social Time: Feminist Perspectives." *Time & Society* 5, no. 2 (June 1996): 169–86.

[9] Barbara Adam, *Timescapes of Modernity: The Environment and Invisible Hazards*, (London, 1998); see also, Adam, *Time*, (Cambridge, 2004). "Homogeneous empty time" was famously articulated by Walter Benjamin in his 1940 essay, "Über den Begriff der Geschichte," most recently translated as "On the Concept of History." For Benjamin, the time of calendars and clocks is seen as homogenous and empty when contrasted with the seasonal and religious conceptions of the passage of time which predominated European temporality prior to the ascendency of clock time. See: Walter Benjamin: Selected writings volume 4, 1838–1940, ed. Howard Eliand and Michael Jennings, (Cambridge MA, 2006), p.395. For recent scholarship on the multiplicity of temporalities, see: Vanessa Ogle, *The Global Transformation of Time: 1870–1950*, (Cambridge MA, 2015); Daniel Stolz, "Positioning the Watch Hand: ʿUlamaʾ and the Practice of Mechanical Timekeeping in Cairo, 1737-1874," *International Journal of Middle East Studies*, 47 (2015): 489-510; Yulia Frumer, *Making Time: Astronomical Time Measurement in Tokugawa Japan*, (Chicago, 2018); Charles W. Mills, "The Chronopolitics of Racial Time." *Time & Society* 29, no. 2 (May

mutability of the Thompson thesis to explain the development of clock time outside of Britain has been further proven inadequate, notably in the early American Republic.[10]

Building from such scholarship, my use of a singular merchant time is understood as an interlinking, rather than flattening, of the multiple temporal structures and timekeeping practices that were at work in the British Atlantic. Whereas previous work on temporality in the colonial and U.S. South has sought to demonstrate that clock time was "the junior partner of sacred and natural time," until well into the nineteenth century, my aim here is rather to illustrate a market-oriented temporality which drew on various timekeeping practices and afforded different technologies different levels of importance for material specific reasons.[11] Borrowing from Jonathan Martineau, I take this merchant time to describe the set of "social time relations" through which various clock times and natural temporal markers were made coherent and oriented towards market structures

2020): 297–317; Mark Hailwood, Time and Work in Rural England, 1500–1700, *Past & Present*, Volume 248, Issue 1 (Aug., 2020), p. 87–121; Gerrit Verhoeven, "Clockwise? Timekeeping in London in the Long Eighteenth Century (1724–1825)," *Cultural and Social History*, Vol. 17, No. 4 (2020), pp. 451-471.

[10] Notable instances of the Thompson thesis as applied to the early republic include the work of Herbert Gutman, Nancy Cott, and David Roediger and Philip Foner. As Thompson saw the rise of clock time as an effect of capitalist production, so too did these scholars (Cott notwithstanding) focus on the free labor factory system of the Northeast. When slavery was reckoned with, as in the work of Eugene Genovese, Thompson's clock time was marshaled in an effort to explain why the slave south was dominated by pre-capitalist labor regimes. As historians of American capitalism have come to regard slavery as essential to the political economy of the United States, so too have they challenged the utility of Thompson's theory in explaining the rise of clock time in the early republic. Gutman, *Work, Culture, and Society in Industrializing America: Essays in American Working-class and Social History*, (Cambridge MA, 1976); Cott, *The Bonds of Womanhood: "Woman's Sphere" in New England, 1780-1835*, (New Haven, 1977); Roediger and Foner, *Our Own Time: A History of American Labor and the Working Day*, (New York, 1989). For more recent critical engagement with Thompson and American temporality see: O'Malley, Michael. "Time, Work and Task Orientation: A Critique of American Historiography." *Time & Society* 1, no. 3 (September 1, 1992): 341–58; Mark M. Smith, *Mastered by the Clock: Time, Slavery, and Freedom in the American South*, (Chapel Hill, 1997); Walter Johnson, "Time and Revolution in African America: Temporality and the History of Atlantic Slavery," in Thomas Bender ed., *Rethinking American History in a Global Age*, (Berkeley, 2002) p. 148-167; Alexis McCrossen, *Marking Modern Times: A History of Clocks, Watches, and Other Timekeepers in American Life,* (Chicago, 2016).

[11] "Junior partner" comes from Smith, *Mastered by the Clock* (1997). Though this is far less a criticism of Smith than it is a recognition of how to study of time has shifted since his book. In 1997, the importance of establishing a hegemonic clock time was seen as central to identification of a capitalist society. That historians can now look beyond a singularly dominant clock and beyond industrialization in tracing the temporal logic of capitalist development is a testament to the work of Smith and others.

in the eighteenth century.[12] Ultimately, by shifting the focus from industrial to merchant capitalism and from a clock time of singularity to a merchant time of multiplicity, a longer and more complex history of time and political economic development is revealed.

Unlike their counterparts in London, colonial watchmakers made few timepieces which directly bore their names.[13] They were instead heavily reliant on transatlantic trade networks of movements, materials, cases, and finished watches to supply their storefronts. Watchmakers' ability to judiciously carry out repair work was paramount.[14] Watches were expensive, and rumors of shoddy workmanship could spell financial disaster. Yet during early 1700s, there were important transformations within the repair industry that prefigured the development of a large commercial market for timekeepers

[12] As Martineau defines them, social time relations are the "'struggling entities' in which different and often contradictory times are organised according to a logic of power, and take contested politico-institutional forms in social time regimes." While broadly adopting Martineau's definition, this paper pushes back on the idea that the various times and timekeeping practices under consideration were ever "contradictory" in their own terms. Rather, these timing technologies were made into competing temporal structures through the contests over the "logic[s] of power" that Martineau eludes to. Jonathan Martineau, *Time, Capitalism and Alienation: A Socio-Historical Inquiry into the Making of Modern Time*, (Chicago, 2016), p.45-6.

[13] Without doubt, those familiar with the history of watchmaking will quickly note the importance of outwork systems—known in Geneva as *établissage*, its name based on the French work for a watchmaker's bench—in eighteenth-century watchmaking. The oft quoted line from Campbell's *London Tradesman* (1740) that, "the Watch-Maker puts his Name upon the Plate and is esteemed the Maker, though he has not made in his Shop the smallest Wheel belonging to it," certainly indicates that watchmakers in London rarely made and assembled every component of their watches. That said, the fact that the watchmaker's name was ultimately the one on the dial is crucial to the distinction between London-based and colonial watchmakers. R. Campbell, The London Tradesman: Being a Compendious View of All the Trades, Professions, Arts, both Liberal and Mechanic…, (London, 1740), p. 252. For more on the importance of outwork in British watchmaking, see: F. A. Bailey and T. C. Barker, "The Seventeenth-Century Origins of Watchmaking in South-West Lancashire," in J. R. Harris ed. *Liverpool and Merseyside: Essays in the Economic and Social History of the Port and its Hinterland* (New York, 1969), p. 1-15; David S. Landes, *Revolution in Time: Clocks and the Making of the Modern World*, 2nd ed., (Cambridge MA, 2000), p. 242-245. For more on établissage production, see Landes (2000), p. 262-171.

[14] This is another point of departure for colonial watchmakers. Whereas Campbell found prices as representing the quality of a watchmaker, colonial watchmakers saw repair work as central to their reputation. In 1772, for instance, Joshua Lockwood took out an advertisement in the *Gazette* informing the city that he had taken over all repair work himself, "on Account of the late repeated Complaints." It is likely that Lockwood had previously delegated repair work to an apprentice. Campbell, *op. cit.*; *SCG,* 11 Feb. 1772, 2-3.

and the ascendency of the 'merchant watchmaker' in the 1740s onward. To see these changes, one needs to look less at the number of watching being repaired and more at the tools and horological instruments availability to watchmakers. The presence of more, and more precise, watch tools in the account books and probates of the city's early watchmakers prefigured the commercial expansion of the watch market in Charleston in important ways.

Nicholas De Longuemare was the son of a Huguenot watchmaker who moved with his father to Charleston in 1686 and served both the English and French Huguenot communities of Charleston as watchmaker in the first decade of the eighteenth century. In 1703, he cleaned and mended a "Comom pendulum Clock" for the former governor James Moore, and carried out further repair and replacement work for a Ms. Dove Williamson and a Mr. Buttler, the latter of whom had lost the crystal for his watch.[15] The following year, De Longuemare mended a clock ("Racommodé un orloge") for Proprietor Deputy and Chief Justice, Robert Gibbes, and fixed a watch owned by the clerk of the Commons House of Assembly, Thomas Hepworth.[16] Further servicing the timepieces of Charleston's elite, De Longuemare carried out additional work for Landgrave Edward Willimot, Nicholas Trott, and Arthur Middleton (1681–1737). While much of De Longuemare's work followed a pattern of cleaning, mending, and crystal replacing, he evidently had the skillset to perform more complex work. In October of 1704, he made a spring wheel and repaired the teeth for a watch belonging to a Mr. Wickley, services for which he was paid "in som watchmakers tooles."[17] Evidently in need of such tools, De

[15] "Account Book of Nicholas De Longuemare," *Transactions of the Huguenot Society of South Carolina*, No. 55 (Charleston, 1950), p. 44.
[16] *Ibid,* p. 46.
[17] *Ibid*, p. 50-1.

Longuemare went on to record far more detailed repair work after receiving them, making replacement pinions, fixing balance wheels, and repairing fusée chains.[18]

When James Batterson died in 1727, this sort of repair work was still the predominate source of revenue for watchmakers. Batterson left behind an estate valued at just under £580, including a range of watchmaking tools such as "an [engine] for cutting clock wheels," an old set of tools, wheels and springs, a 30-hour clock, a clock case, a silver repeating watch valued at £90, a plain silver watch, an 8-day clock movement, and £250 in book debts. Watch engines had existed in various forms since the seventeenth century, but it was in the eighteenth that their use became more standardized among watchmakers looking to cut more uniform wheel teeth more efficiently. Batterson's tools and wheel cutting engine were the most valuable items in his estate, apart from the silver repeater sold to cover the funeral costs. Batterson's livelihood as a watchmaker clearly depended on repair work given the evidence of book debts, spare movements, and individual parts. Knowing how important repairs were, he bequeathed all his tools "relating to the making or mending of clocks or watches" to his fellow watchmaker John Harris.[19]

Harris's own probate from 1738 indicates a further expansion of watch repair work. He left behind an estate of comparable wealth to Batterson, but with a far more robust assortment of tools and materials. This included 116 crystals, a complete workbench, 4

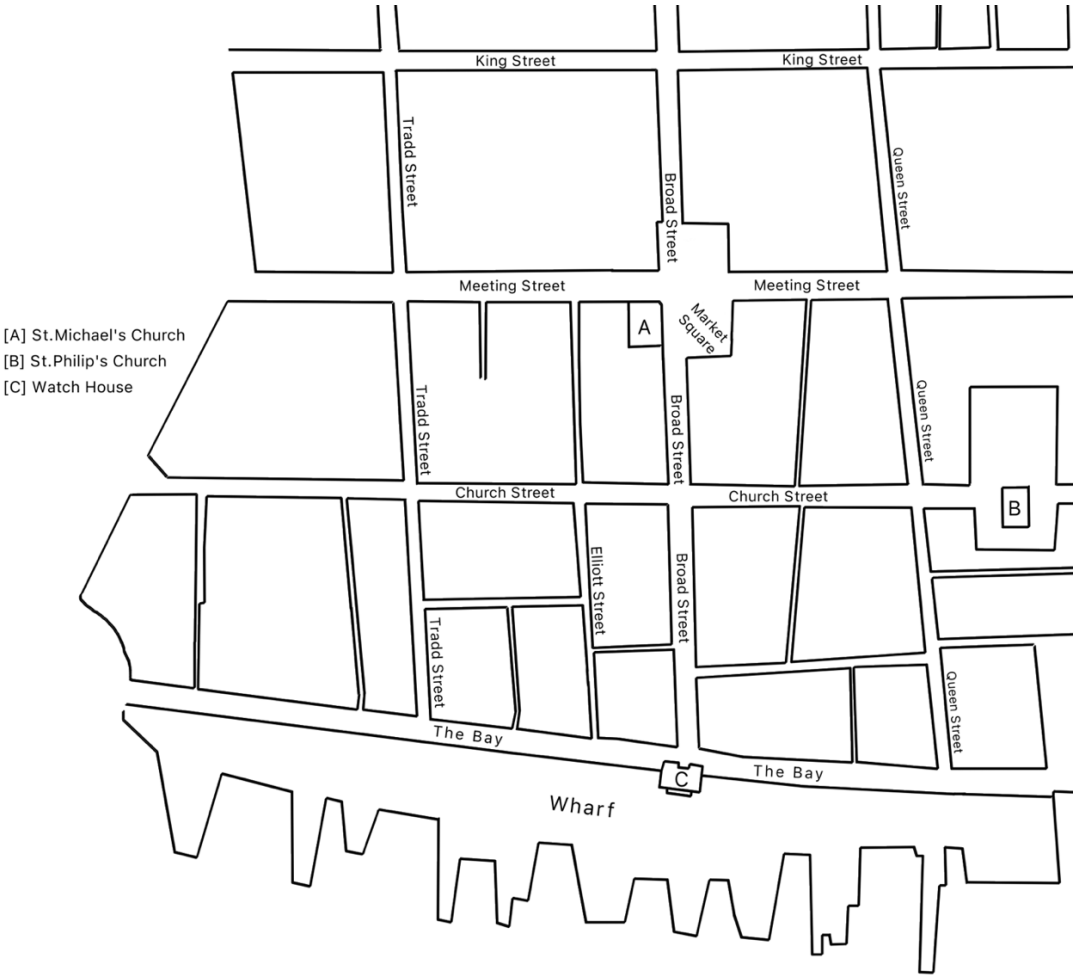
[18] The fusée was a crucial component to the popular verge escapement watches of the day. Shaped like a vertical cone within the movement of the watch, the fusée had a small chain wrapped around it which released power to the balance. As verge watches unwound, the power stored in the watch would decrease and slow down the watch. The cone-shaped fusée compensated for this so that as the watch powered down, the energy required to unwind the chain around a smaller and smaller circumference, and thus direct power to the balance, decreased with it. Keeping a verge watch accurate therefore necessitate an extreme balancing act in regard to power distribution, chain length, and fusée shape.

[19] "Estate Inventory of James Batterson, clockmaker" *Museum of Early Southern Decorative Arts*, Craftsmen Database.

verge escapements, a main spring, pining wire, 9 lathes, files, hour hands, hammers, a loupe, silver watches, a repeater, and "one clock engine."[20] While it is impossible to say just how many clocks and watches were in Charleston at the time, the contrast in repair items between Batterson and Harris is indicative of the growing importance of timekeeping in the city. Moreover, Harris's probate illustrates the growing demand placed on watchmakers to have a far more extensive set of tools and indicates that repair work was no longer regarded a rudimentary task. There was practical reason for this. As watches became more accurate and began showing quarters and minutes in addition to hours, the degree of perfection required during repair increased accordingly.

Around the time of Harris's death, the market for watches and watchmakers in Charleston had begun to more closely resemble the space that Joshua Lockwood would enter in 1757 than the one which De Longuemare and Batterson had left behind. *The South Carolina Gazette*, first printed in 1731, now featured advertisements from watchmakers offering repairs and the occasional imported watch alongside notices of stolen or lost timepieces. Concentrating ever more so in the commercial center of Charleston, watchmakers championed their repair talents and associate toolkits in an effort to attract patrons from a growing consumer base.

[20] "Estate Inventory of John Harris" *Museum of Early Southern Decorative Arts*, Craftsmen Database.



Most merchants had set up their storefronts close to the wharf by the middle of the century. In particular, Broad Street and the East Bay became the favorites of those who made their living on imports and exports, and as a result they drove rents up and domestic artisans further from the port. In addition to greater foot traffic, these streets had lower carrying rates for goods. Carriage to and from Church Street cost 5 shillings per load, with increasing rates of over 7 shillings to Meeting Street and 10 to King Street and beyond. As others have noted, the lack of any quoted rates for Broad Street and the East Bay are indicative of how highly merchants valued the area.[21] Watchmakers

[21] *SCG*, 9-16 July 1750, cited in: Jeanne A. Calhoun, Martha A. Zierden, and Elizabeth A. Paysinger, "The Geographic Spread of Charleston's Mercantile Community, 1732-1767," *The South Carolina*

were no different, and their movement towards this area was reflected in address changes in newspaper notices. Between 1740 and 1770, three quarters of all watchmakers who moved or opened new shops did so in the area around Broad Street, Elliott Street, and the East Bay.

The spatial centralization of Charleston's watchmakers coincided with the North American and West Indian markets becoming ever more important to British watch exports. Whereas customs officials in the first decade of the century record just shy of 1,000 watches leaving London ports, the 1730s saw British watchmakers produce 15,500 timepieces for export and over 70,000 between 1770-80. The German and Dutch markets, which had sustained much of this growth, reduced considerably in the 1740s and 50s such that British totals in each decade were little over 8,000. The colonial market, which had never comprised more than 7% of Britain's watch exports, jumped to an average of 20% in the late 1750s as a result of Britain's engagement in the 7 Year's War (1756-1763). Following the war, even as the continental market regained its predominance, export totals to the colonies remained high. Whereas the colonies imported just under 60 watches a year in the 1750s, the market doubled over the next decade.

The relative importance of the North American colonies, and the Carolina market specifically, grew as the total number of colonial imports increased. The West Indies, which had imported twice the number of watches as the North Americans in the 1730s and 40s, fell to less than a quarter of the total colonial market in the 1750s. Throughout, Carolina was regularly the largest single market in North America and constituted 36%

Historical Magazine 86, no. 3 (1985): 189-90.

of imports in the 1730s. Its market size continued to grow as North America overtook the West Indies. In the 1750s, Carolina represented close to 50% of North American watch imports and had imported six-times as many watches as it had in the decade prior. Relative to the total colonial market, West Indies inclusive, Carolina grew from 7% in the 1730s to 37% in the 1750s. While the imperial crisis and non-importation movement of the mid- to late-1760s disrupted the watch trade, Carolina nevertheless imported close 95% of their 1750s total in the first six years of the 1760s.[22] By 1767, leading Charleston merchants Peter Manigault and Henry Laurens both had to inform their confrères in Pennsylvania and Georgia respectively that they could not sell any watches on their behalf. "Your watch is not sold," Laurens wrote to Georgian merchant James Habersham, owing to "such a superabundance of Watches, jewelry, &ca. imported here that the Sales are…slower than I had imagined."[23]

British Watch Exports to North American and West Indian Colonies

	Carolina Exports	*Total N.A. Exports*	*Total W. I. Exports*	*Total Exports*	*Carolina as % of N.A. Exports*	*Carolina as % of Total Exports*
1730-39	8	22	99	121	36%	7%
1740-49	34	81	92	173	42%	20%
1750-59	218	451	138	589	48%	37%
1760-69	220	958	239	1197	23%	18%

Source: Customs Ledgers Series 3/30-70, PRO

[22] Export figures come from Customs Ledgers Series 3/30-70, PRO.
[23] Smith, *Mastered by the Clock*, p. 30-1.

While the colonies never constituted more than roughly one-fifth of British exports, and even then, only briefly, they nevertheless experience a market boom in the watch market. Nowhere was this growth more apparent than in Charleston. With more watchmakers in an ever more concentrated area of Charleston, the watch trade shifted from greater and more detailed repair work towards a focus on importing higher quality and larger quantities of watches from British makers. As a result, merchant watchmakers began to champion their relations to the production of watches and the technological innovation of their wares as key selling points in evermore detailed advertisements.

Yet despite an influx of watch imports beginning in the 1740s, there was a relative lull in the number of watchmakers actively working in Charleston when Joshua Lockwood arrived in January 1757. Thus, when he took out an advertisement in the *South Carolina Gazette* informing "the ladies and gentlemen of [the] province" that he was to "follow the art or calling of watch and clocking making, mending, and repairing," in the carpentry shop of Thomas Lee, there was clear need for his services.[24] Offering a warranty of a dollar a year on all new and second hand watches he sold, Lockwood was met with good business and moved to his own shop on Broad Street with his wife Mary

[24] *South Carolina Gazette*, Charleston, 13 Jan. 1757, 3-2. Little is known about Lockwood prior to this advertisement. His father, Joshua Lockwood Sr., arrived in South Carolina 5 years before his son was born. Antiquarian horologist James W. Gibbs suggests that Lockwood returned to England at some point to learn the watchmaking trade. See: Gibbs, *Dixie Clockmakers* (Gretna: Pelican Publishing, 1979), p.129. However, Lockwood makes no note in his introduction to Charlestonians that he is "well bred" (a phrase denoting the completion of a guild apprenticeship) in the trade, nor does his name figure in any official registers for the clockmakers, blacksmiths, or goldsmiths guilds. This is not to say Lockwood was untrained. As Kelly and Ó Gráda have noted in their study of English watch prices, the eighteenth century saw the power of the guilds to place meaningful restriction on watchmaking apprentices decline precipitously. See: Morgan Kelly, Cormac Ó Gráda, "Adam Smith, Watch Prices, and the Industrial Revolution,"*The Quarterly Journal of Economics*, 131:4, 2016, p.1744.

(née Lee) and his son Joshua (b. 1758) in late 1759.[25]

He had become a well-established merchant watchmaker in Charleston by November 1764 when he took out an ad in the *Gazette* offering gold repeaters and stop-watches for £140-180, silver and metal watches for £25-80, and "some of a new construction." Lockwood concluded his advertisement by boldly asserting that his £25 watches were of equal quality to those sold for four guineas in London.[26] As any well-informed merchant in Charleston understood, 4 guineas was close to a pound sterling greater than the par rate for £25 current money in South Carolina. At a time when watches were becoming equally reliable markers of time as they were status, owning the latest in both form and function was of paramount importance.[27]

It was that final claim which provoked the ire of fellow Charleston watch merchant, John Paul Grimke, who soon took out a notice of his own. In it, he advertised "Silver and Pinchbeck watches, which cost *Three Guineas, at Twenty Seven Pounds*," and accused Lockwood of passing off second-hand watches as new. Asserting that "as all his watches…are from the best hands, made by his particular directions, and bought with cash," it was impossible, Grimke reckoned, to offer genuinely a new timepieces at prices as low as Lockwood was promising. "A watch which cost *Four Guineas* in London

[25] *South Carolina Gazette*, Charleston, 10 Nov. 1759, 3-2. For marriage and birth see: D.E. Huger Smith, A.S. Salley Jr., ed., *Register of St. Philip's Parish, Charles Town, or Charleston, S.C. 1754-1810* (Columbia: University of South Carolina Press, 1971), p. 8, 147.
[26] *South Carolina Gazette*, Charleston, 26 Nov. 1764, 3-2.
[27] Erring on the side of hyperbole, it is simply impossible to determine the validity of Lockwood's statement regarding the value of his watches. Calculations of South Carolina currency to the pound sterling are based off McCusker's invaluable work on seventeenth- and eighteenth-century exchange rates; see John J. McCusker, *Money and Exchange in Europe and America, 1600-1775: A Handbook*, (Chapel Hill, 1978), p. 224. For watches as status markers in Charleston see: Mark M. Smith, "Counting Clocks, Owning Time: Detailing and Interpreting Clock and Watch Ownership in the American South, 1739-1865." *Time & Society* 3, no. 3 (October 1994): 321–39. The broader development of bourgeois sensibility in British culture is elaborated on in John Brewer, *The Pleasures of the Imagination: English Culture in the Eighteenth Century*, (New York, 1997).

cannot be new," he concluded, "to be sold here at *Twenty-five Pounds*."[28]

In turn, Lockwood marshaled a spirited defense of not just himself, but of watchmakers writ large. Pointing to the fact that Grimke himself was not a watch*maker* but rather a merchant who sold watches, Lockwood cited his technical insights into the 'mystery' of watchmaking as evidence for his claims.[29] "Is it possible," he questioned, "that a man who knows not a wheel from a pinion, nor a movement from a motion, should give particular directions [on] how to make up a watch?" Clarifying that he had compared the quality, not the price, of his £25 watches to the four guinea timepieces sold in London, Lockwood again attacked Grimke's presumed ignorance of watch production, stating that "he who knows the value of every article, must know what they [watches] can be made up for, and also, how to allow a living profit to his workmen."[30] That Grimke was unaware of these factors, Lockwood resolved, rendered him unable to determine the true quality, and therefore, value of a watch.

Owing to his long trail of advertisements and active role in Revolutionary Charleston, historians have looked to Joshua Lockwood and found evidence of Charleston's elite adopting a uniquely provincial spin on London's "genteel culture," as readily as they have found a revolutionary impulse running through the city's artisan class. In both instances, Lockwood's status as a watchmaker has been less important than the contexts of haute culture and crisis that his advertisements have reflected. Conversely, antiquarian horologists have taken Lockwood and his surviving timepieces as snapshots

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[28] *South Carolina Gazette*, Charleston, 17 Dec. 1764, 2.
[29] The language of shrouded knowledge with respect to clock and watchmaking dates at least to the founding of the Worshipful Company of Clockmakers in 1631. The Company's charter of that year repeatedly made reference to "the art and mystery of clockmaking." See: Samuel Elliott Atkins and William Henry Overall, *Some Account of the Worshipful Company of Clockmakers of the City of London*, (London, 1881), p. 7-8.
[30] *South Carolina Gazette*, Charleston, 7 Jan. 1765, 3.

of eighteenth-century watchmaking. Invaluable as these technical studies have been, horological interest in Lockwood's world has rarely extended past the rarity of his work surviving to the present day.[31] Yet, as his exchange with Grimke further shows, by the middle of the century, the watchmaking and the technical skills required to satisfy timekeeping needs had evolved from a mastery of repair into a discourse of commodity production and exchange.

Those not in the watch trade took notice of mechanical timekeeping's growing importance to the economic and social life of the city. Grimke, who throughout his life marketed himself as a silver smith, was one of the first to recognize this important shift. His advertisements from the early 1740s indicate that, in addition to his smith work, he had staked a large portion of his business in the jewel trade. His notices gave pride of place to the "assortment[s] of brilliant and rose diamonds, rubies, cornelians, emeralds, saphirs [sic], topaz's,…[and] christals of all sorts and sizes," over and above his own gold and silver smithing. When Grimke did have watches on offer, he had little to say beyond the metal used to make the case or chain.[32] By the 1750s, Grimke's marketing focused had noticeable changed. Sparse mentions of "silver watches" had given way to top line notices of eight-day clocks, "repeating watches in gold and pinchbeck," as well as "horizontal and stop watches with second hands."[33] In 1752, he gave an enumerated list of his goods for sale and their prices. Included were far more detailed descriptions of

[31] See: Emma Hart, *Building Charleston: Town and Society in the Eighteenth-century British Atlantic World*, (Charlottesville, 2010), ch. 4, esp. p. 135; Richard Walsh, *Charleston's Sons of Liberty: A Study of the Artisans, 1763-1789*, (Charleston, 1959). For treatments of Lockwood by horologists, see: Richard Newman, "An 18th-Century Plantation Owner's Watch," *North American Watch and Clock Collectors Watch and Clock Bulletin,* no. 439 (May/Jun., 2019), p. 211-16. [Hereafter, *NAWCC Bulletin*]
[32] *SCG*, 24 April. 1742, 3-2. See also, *SCG*, 24 Jan., 1742/3, 3-2.
[33] *SCG*, 29 Jan, 1756, 4-1.

the timepieces on offer, and Grimke made a point of noting that some of the "plain & cased gold watches" were of "Graham's make."[34] As the former apprentice and later collaborator of Thomas Tompion, George Graham was widely regarded as "the most eminent" of Britain's watchmakers in the decades after Tompion's death in 1713. Graham's work earned him considerable plaudits across the Atlantic such that the *South Carolina Gazette* ran a front-page eulogy to him in the months following his death in 1751.[35]

Grimke was not alone in using the reputation of English watchmakers as a selling point. Lockwood, riding on the success of John Harrison's marine chronometer and the public encouragement it had received from the likes of Graham, invoked the language of longitude to market his watches. In June 1766, he advertised watches with "the construction in part being taken from Mr. Harrison's time-keeper."[36] The determination of longitude at sea was a question of vital concern to British trade, so much so that in 1714 the state had supported a public prize of up to 20,000 pounds for its solution. To understand the importance of Lockwood's invocation, a brief account of Harrison and longitude question is necessary.

Harrison's marine chronometer, known as Harrison No. 4 or 'H4', was first tested in 1762 on a voyage from Portsmouth, England to Kingston, Jamaica. The trial was a success, with the H4 maintaining time within one nautical mile of Kingston's longitude. The Board of Longitude, chaired by Astronomer Royal Nevil Maskelyne, questioned whether the results were true or a fortuitous miscalculation on the part of the crew. H4

[34] *SCG*, 10 Aug, 1752.
[35] *SCG*, 20 Apr., 1752. See Smith, *Mastered by the Clock*, p. 22 for cultural significance of Graham's eulogy in regards to precision timekeeping needs in Charleston.
[36] *SCG*, 17 June, 1766, 3-1

was tested again in 1765, this time on a trial voyage to Bridgetown, Barbados. Results showed that the marine chronometer was accurate within 10 nautical miles of Bridgetown. Once again, Maskelyne, who himself was attempting to solve the longitude question through a system of lunar distancing, threw out the results as a miscalculation. Harrison and his supporters waged a public pressure campaign soon after, and he was awarded 5,000 pounds by Parliament later that year.[37]

The British public soon turned on the Board of Longitude as it demanded to know how Harrison had solved the greatest navigational question of the era. "We desire to know," one writer asked in *The Public Advertiser*, "why the Secret is not published to the World, for whose general use it was intended." Given that the H4 took Harrison six years to construct, there was genuine concern as to the utility of his watch. "If nobody but Mr. Harrison can make the Machines," the pieced continued, "he and his Discovery may as well have been at the Bottom of the Sea for any Good the World will receive from them." The demand for Harrison's "secret" seemingly transcended Britain's rivalry with France. Upon hearing that Ferdinand Berthoud—a Neuchâtel-born watchmaker in the employ of the French Navy—had been told how the H4 worked, the author was both jubilant and apologetic; "We are very glad of it…and are only sorry that he should be under the necessity of stealing what ought to have been given [to] him." Decrying the Board of Longitude for playing politics with such a vital construction, the piece asked if it was "honour enough" for Britain to have solved the longitude question. "It was never our Intention," they continued, "of keeping the Secret to ourselves."[38]

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[37] For an accessible narrative of John Harrison's dealings with the Board of Longitude, see Dava Sobel, *Longitude The True Story of a Lone Genius Who Solved the Greatest Scientific Problem of His Time*, (New York, 2007).

[38] *The Public Advertiser*, 21 Nov., 1766, 2-1.

Timing here is important. Lockwood's advertisement of components "taken from Mr. Harrison's time-keeper," appeared in June 1766, but the tell-all, *Principles of Mr. Harrison's Time-Keeper…,* was not published by the Board until 1767.[39] Nevertheless, there was at least one other watchmaker in London who know how the H4 operated. A condition of Harrison receiving his reward in 1765 was that he disclose the workings of his chronometer to the Board's commissioners, one of whom was George Graham's former apprentice, Thomas Mudge. In August 1765, Mudge, Maskelyne, and other commissioners visited Harrison's workshop and certified that he had "taken his Time Keeper to pieces in presence of us, and explained the Principles and construction thereof and every thing relative thereto to our entire satisfaction."[40] Mudge was seemingly of a similar disposition to that of the *Advertiser* author. He later testified that he "thought it [his] duty" and "the intention of the Board" that he share the principles of the H4 with others and stated that he explained the inner workings of the H4 to "10 or 12" other workmen in London in addition to Berthoud.[41]

Charleston merchants followed proceedings of the Board with great interest, and the *South Carolina Gazette* regularly published letters and accounts detailing newly proposed solutions as well as the latest developments in Harrison's feud with the

[39] *The Principles of Mr. Harrison's Time-Keeper, with Plates of the Same. Published by order of The Commissioners of Longitude*, (London, 1767).
[40] "Harrison Journal" RGO, H/17809, p.165-6.
[41] Confirmed minutes of the Board of Longitude 1737-1779, RGO 14/5 p.145-6. Mudge, for his part, later received an order from Henry Laurens' brother James who hoped to gift a watch to his nephew, John, but the order was eventually retracted. In a letter written shortly before he went to study in Geneva, John wrote: "You were so kind My Dear Uncle, as to send an Order to Mr. Mudge for a Watch for me. But as he says he can't deliver one under twelve months even from this time, and I am to begin a little time at Geneve, where the best Machinery of this kind is to be had at the cheapest rate, I believe it will be better to withdraw the Order from Mr. Mudge which he very readily consents to and for Papa to get one at Geneve, where he shall be better served and save perhaps from 10 to 20 Guineas." John Laurens to James Laurens, April 17, 1772, *Henry Laurens Papers*, South Caroliniana Library, University of South Carolina. https://digital.tcl.sc.edu/digital/collection/amerrevsc/id/2540/rec/168

commissioners.[42] This is not entirely surprising. Harrison's trial voyages to Kingston in 1762 and Bridgetown in 1765 were destined for cities which most resembled Charleston in both economic activity and urban development in the eighteenth century.[43] While it is impossible to say whether or not Lockwood's watch genuinely did contain elements of Harrison's chronometer, the advertisement is nonetheless illustrative. At a time when interest in the H4 was at an all-time high and public knowledge of its workings still shrouded in mystery, Lockwood's offer of owning a watch even somewhat connected to the longitude question served to set him apart from other watchmakers. He conveyed a sense of insider access to the great maritime question of the day, signaling to the merchant community of Charleston that he alone possessed the horological instruments necessary for successful Atlantic navigation.

The importance of South Carolina's slave plantation system to Charleston's Atlantic-facing economy was similarly reflected in watchmaker's advertisements. Planters sought to reconcile their sense of clock time with what they viewed as 'pre-modern' natural timekeepers. As such, clocks that symbolized white settler ideologies and ascribed race to non-clock timing practices were particularly appealing. Watchmakers refashioned clock arches and replaced more conventional depictions of the moon or sun with scenes more enticing to elite white consumers. Lockwood advertised a clock with an "invention" of his own, the depiction of a slave laborer in the arch with the motto

[42] See: *SCG*, 4 Jan., 1734, 1-1; 1 Oct., 1753, 2-2; 25 May, 1765, 2-2; 14 Jan., 1766, 2-3; 8 Sept., 1767, 2-2.

[43] On similarities between Charleston and the West Indies, see: Trevor Burnard and Emma Hart, "Kingston, Jamaica, and Charleston, South Carolina: A New Look at Comparative Urbanization in Plantation Colonial British America," *Journal of Urban History* 39, no. 2 (March 1, 2013): 214–34; Emma Hart and Cathy Matson, "Situating Merchants in Late Eighteenth-Century British Atlantic Port Cities," *Early American Studies: An Interdisciplinary Journal* 15, no. 4 (2017): 660–82; and Trevor Burnard, "Towns in Plantation Societies in Eighteenth-Century British America," *Early American Studies* 15, no. 4 (2017): 835–59.

"Success to the Planters."[44] He similarly sold a clock "with the representation of a Cherokee Fight in the arch" alongside one showing a slave beating rice; advertised as something "he seems to do very naturally."[45] Alarm clocks were further advertised as being particularly useful for "call[ing] an overseer up at what hour the gentleman pleases."[46] Be it the moon or sun, indians or slaves, the control over natural timekeeping by the hands of the dial was the clear intent. If agricultural production was largely dictated by the rhythms of celestial bodies, slave labour could, at the very least, be 'mastered by the clock'.[47]

Laws relating to merchant time were enacted in accordance with these transformations in watchmaking and advertising. The colonial elite and merchant class of Charleston were indeed quite comfortable in structuring the city's commercial activities along both solar and clock time keeping. Viewing neither as a "junior partner" to the other, both the sun and the clock were used to maintain the growth of Charleston during the eighteenth century. Laws were passed to disincentivize potentially dishonest merchants from trading in contraband and deceit alongside legislation which correlated an undifferentiated 'night' with moral depredation. The use of a predictable clock time, it was believed, afforded a rational ordering of consumption and production, in market squares and plantation fields.

In 1719, the colonial legislature passed a statute stipulating that merchant vessels entering the port were prohibited from unloading their cargoes at night. Mobilizing the

[44] *SCG,* 21 Mar. 1761, 2-1.
[45] *SCG,* 8 Oct. 1763, 1-2.
[46] *SCG*, 11 June 1763, 2-2
[47] Derived from the title of Smith, *Mastered by the Clock* (1997).

vigilance of a daytime public gaze, one which had long been a means of spiritual and moral surveillance, the law threatened the seizure and forfeiture of all “negroes, liquors, goods or merchandize” that was unloaded at any time other than “between sun-rising and sun-setting.”[48] Enforcement of the statute fell on the night watch. Established in 1698, the watch patrolled the city “from the hour of eight at night to the hour of six in the morning,” between the middle September to March, and “from the hour of nine at night, to the hour of four in the morning,” between the middle of March to September.[49] Aligning clock time with the vernal and autumnal equinoxes, the legislature’s use of the night watch to mark out the temporal bounds of imports and exports augured the beginning of merchant time’s importance to the growth of Charleston.

The legislature further passed a new market regulation act in 1739 that was designed to inhibit “engrossing, forestalling, regrating, and unjust exactions.” Primarily aimed at controlling the sale of meat, the act enforced a 5-pound fine and confiscation of goods on anyone selling “beef, mutton, veal, lamb, pork and other butchery wares,” outside of the market space or within a 1-mile radius of the city.[50] Once inside the confines of the market, “every butcher and butchers, poulterer and poulterers, county planter, victualler, lader, kidder,” or otherwise was free to sell their goods on “every day of the week except Sunday,” with the ringing of the opening bell.[51] Recognizing that different facets of Charleston’s economy operated through coherently diverse ways of telling time, the act stipulated that the bell would be rung by the clerk of the market, “at

[48] *The Statutes at Large of South Carolina*, v.III, ed. T. Cooper and D. J. McCord, (Columbia, S.C.: A.S. Johnston, 1836-1898), p.61. [Hereafter: *SLSC*]
[49] *SLSC,* VII, p.8
[50] *SLSC,* IX, p.692.
[51] *SLCS,* IV, p. 693

sun rising, and also at nine of the clock in the morning, on every market day throughout the year, *on pain of forfeiting the sum of five pounds for every neglect*."[52] Not only would the clerk be found in a state of neglect if either the natural or clock-based time markers were not attended to, but the penalty for failing to ring the bell was more than twice that of violating the temporal regulation. Publicly enforcing adherence to the market-oriented merchant time was of principle concern.

Cast as the application of clock time to "the care [and] management…of slaves," out of concern for their having "sufficient time for natural rest," the infamous 'Negro Act' of 1740 illustrated the planter class's reliance on merchant time to maximize the amount of labor that could be extracted from their slaves. The calculation was simple. During the autumn and winter months, masters were barred from working their slaves "more than fourteen hours" in a 24 hour period. In the spring and summer, when there were more day light hours, the act stipulated that masters were permitted to work their slaves one additional hour per day.[53] The simple truth of agricultural labor requiring day light belies the concern for "natural rest." In an economy dependent on rice production and export, the planter class mobilized merchant time as the optimal way of controlling enslaved labor time for as many hours as they profitably could.[54]

The 1741 passage of an act designed to regulate taverns and punch houses furthered cohered natural and clock markers. Aimed at reducing the number of "unfit and unqualified" tavern keepers who had obtained liquor licenses, the Legislature

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[52] *Ibid.* Emphasis my own.
[53] *SLSC,* VII, p.413
[54] As Caitlin Rosenthal has shown, slave masters were meticulous in their calculations of slave productivity per hours or days worked. Moreover, Rosenthal demonstrates that time scales of varying agricultural commodities greatly informed how masters set hours and evaluated labor time efficiency. See: Rosenthal, *Accounting for Slavery: Masters and Management*, (Cambridge MA, 2018), esp. p. 67-71, 104-120.

sought to improve the "common good and welfare of [the] Province," which was believed to be under attack by the, "the abundance of taverns, punch houses and blind tippling houses."[55] Included a statute that proprietors of such establishments would face a four-pound penalty if they were found allowing patrons to play billiards "after the sun hath been set one hour."[56] Elite Carolinians needed only to recall the character of Death in Milton's *Paradise Lost* to understand the grave moral importance of bringing order to night:

> *The other shape,*
> *If shape it might be called that shape had none*
> *Distinguishable in member, joint, or limb,*
> *Or substance might be called that shadow seemed,*
> *For each seemed either; black it stood as Night,*
> *Fierce as ten Furies, terrible as Hell,*
> *And shook a dreadful dart; what seemed his head*
> *The likeness of a kingly crown had on.*[57]

Thus, while temporal regulation designed to control market activity was squarely in the purview of public timekeeping, moral reform was dependent on decidedly private timepieces. If public bells were the signal to open the market, private clocks and watches determined when it was time to leave the billiard's table. That no mention of public or private timekeeping appears in the Negro Act is revelatory of how important

[55] *SLSC,* III, p. 581-2.
[56] *SLSC,* III, p. 585.
[57] John Milton, *Paradise Lost*, II.666-71.

minutes and hours were compared to the light of day. Nonetheless, the subordination of clocks to nature and nature to clocks indicates the flexibility of the social time relations at work.

The letters of Henry Laurens provide a useful case study of merchant time in practice. As both a merchant and planter, Laurens regularly invoked both solar and mechanical timekeeping in his correspondences. His temporal frame of reference would often shift depending on the topic he was discussing. Tides and seasons were of equal importance as hours and days for Laurens, and one was no less precise than another. Containing different sets of information vital to his various enterprises, we see in Laurens' letters the workings of social time relations in which merchant capital adopted timekeeping practices as they appeared.

Laurens often used tides to mark the passage of time when discussing shipping with his fellow merchants. He bemoaned in a letter to one of his contacts in Bristol that a slave ships of his had run aground when traveling up river to air it for small pox. As the ship had "[laid] for 3 or 4 Tides," Laurens worried that this delay would keep the ship in Charleston for close to month as it was refitted.[58] Elsewhere, he gave notice to the Bristol firm of Cowles & Hartford that "about 720 Barrels [of] Pitch, 200 of Green Tar, & 80 [of] Turpentine" had been loaded onto the *Glocestershire* and that "the Ship will sail next spring Tides." As well-established figures in the merchant community of Bristol, Cowles & Hartford understood spring tides. Yet in a letter to the planter Samuel

[58] Laurens to Thomas Easton & Co., June 23, 1755, in *The Papers of Henry Laurens*, vol. 1, *September 11, 1746–October 31, 1755,* ed. Philip M. Hamer and George C. Rogers Jr. (Columbia, S.C.: University of South Carolina Press, 1968), 266. [Hereafter *PHL*]

Wainwright, Laurens clarified that a ship departing "upon the Spring Tides," was bound to leave "after the next New Moon."[59] The overseer at Mepkin Plantation was similarly informed that a large delivery of turnip seeds would arrive "before the Full Moon."[60] Recognizing the conceptual limits of tides, Laurens understood that they were nevertheless useful time markers for merchants.

Like other natural timekeepers, tides were important because they were generally predictable. The first South Carolina almanac, published in 1751, allowed merchants like Laurens to forecast the tides with greater astronomical certainty due to the calendar of moon phases.[61] When such practices were disrupted, Laurens relied on alternative timekeeping practices to describe events. Following the Lisbon Earthquake of 1755, he wrote to Barbadian planter Gidney Clarke that "the extraordinary flux and reflux of the Tide at your place," had similarly affected Bermuda. The cause, he explained, was the result of three shocks in Portugal that spanned "from ten in the morning to seven at night," the first of which had "continued no less than ten minutes." Laurens relayed to his associates in Liverpool the following day that there was "a constant flux and reflux of the Sea every five or six minutes for Hours together," reaching as far as Bermuda and the Leeward Islands.[62]

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[59] Laurens to Cowles & Hartford, May 14, 1763; and to Samuel Wainwright, June 20, 1762, in *PHL*, v.3, (1972), 447, 475.

[60] Mepkin Plantation was Lauren's country home as of 1762. Laurens to John Smith, Sept. 17, 1765, *PHL*, v.5, (1976), 6.

[61] Advertisement of *The South Carolina Almanack for the year 1752* first appeared in the *Gazette* on December 6, 1751. It's author, John Tobler, was a Swiss émigré who left the half-canton of Appenzell Ausserrhoden in 1737. In 1753, Tobler wrote *Beschreibung von Carolina* (*A Description of Carolina*) for a Swiss almanac. His aim was to encourage further immigration to the Carolinas from the german-speaking cantons of Glarus, Appenzell, and Grisons. Mabel L. Webber, "South Carolina Almanacs. To 1800." *The South Carolina Historical and Genealogical Magazine* 15, no. 2 (1914): 73; For more on Tobler and a translation of his *Description*, see: Walter L. Robbins, "John Tobler's Description of South Carolina (1753)," The South Carolina Historical Magazine , Jul., 1970, Vol. 71, No. 3 (Jul., 1970), pp. 141-161.

[62] Laurens to Gidney Clarke, Jan. 12, 1756; and to Thomas Mears & Co. Jan 13, 1756, in *PHL*, v.2, (1970), 64, 67.

As readily as Laurens adopted tidal and clock timing practices in his merchant endeavors, so too did he rely on the seasons. In March of 1769, he informed Cowles of the difficulties he faced in finding and delivering an ample supply of pine planks. Not only was "the Season of the Year…unfavorable," he explained, but the "Oxen for carting [were] very poor" and the majority of Carolinians were busy planting. Recognizing that further delays would likely result in costly shipworm damage, Laurens told Cowles he was inclined to fill up the Vessel with Rice…and send her away."[63] After receiving a shipment of rotten madder, he wrote to his English counterpart that if another order were to be sent in December or January, it would "arrive [in Charleston] at a proper Season for Planting."[64] While seasonality was a perennial issue for Laurens, he was also able to use this time reckoning to his advantage. In April 1769, he informed the Bristol merchant Henry Bright that he had closed "150 Barrels of Rice at 60/per Ct. [in addition] to the 350 Barrels formerly advised of at 55/per Ct.," on Bright's on account, "thinking it unsafe any longer to delay." Laurens explained that, during the Summer months, "the arrival of half a dozen Vessels or any little unexpected demand for Rice puts it in the Power of the Factors to make as it were their own price." With the knowledge that European prices were rising and Carolina's about to join them, Laurens' seasonal time reckoning ensured he and his partners would not be caught holding the bag when prices fell back down below 60.[65]

Revealed through Laurens' correspondences is the ease with which merchant time oriented a range of timekeeping practices to commercial activity. Tides, clocks, and

[63] Laurens to William Cowles & Co., Mar. 22, 1769, *PHL*, v.6, (1978), 414
[64] Laurens to Richard Oswald, Oct. 10, 1767, *PHL*, v.5, (1976), 349-50.
[65] Laurens to Henry Bright, Apr. 14, 1769, *PHL*, v.6, (1978), 414

seasons all held temporal significance which informed his business practices. As Laurens shifted back and forth between his merchant and plantation enterprises, so too did the methods by which he marked time. Rather than seeing these shifts in time reckoning as more or less precise or evidence of unequal market dependence, the conceptual ease with which Laurens conducted himself at various timescales is evidence of a merchant capitalism that mobilized different timing practices to meet different timing needs.

The growth of Britain's Atlantic watch market was inseparable from the development of a merchant time consciousness which had come to govern daily live and commercial activity by the middle decades of the eighteenth century. In Charleston, this transformation was prefigured by watchmakers who had steadily expanded in their ability to carry out greater degrees of watch repair work. Concurrent with this reputation-building, the watch export industry in England grew at a staggering rate. With greater metropolitan production came greater colonial consumption, and by the 1750s Carolina was the single most important North American market for British-made watches.

As mechanical time reckoning became a more accurate and more affordable practice, watchmakers in Charleston pitched themselves as possessing both the technical skills and commercial connections necessary to service the timekeeping needs of merchants and planters alike. As a result, advertisements that contained detailed descriptions and watch provenance became ever more commonplace. Yet rather than displacing solar or 'natural' methods of timekeeping, clocks and watches were integrated into the social time relations which governed Britain's Atlantic economy.

This merchant time was expressed through a range of timekeeping practices, and these practices were equally regarded as accurate ways of structuring the city's economic activity. As we have seen, the market bells that were rung at daybreak were also rung at 9 o'clock, and potential ne'er-do-wells were driven from billiards tables an hour after sunset. The letters of Henry Laurens further reveal how this merchant time operated. As both a merchant and planter, Laurens used tides and seasons alongside clocks to mark the passage of time.

Charleston's standing as both an agricultural and commercial hegemon in the eighteenth century Atlantic lends itself well to an analysis of how merchant time was adapted to a variety of material conditions. Yet Charleston was not unique in the development of merchant time, despite the exceptional state of its watch imports. Similarly robust communities of watchmakers existed in Boston, New York, and Philadelphia, and the time relations that integrated these cities into the Atlantic world are deserving of their own investigations. Furthermore, seeing the eighteenth century as a unique period in the history of temporality remains an essential task. The complimentary status of solar and mechanical timekeeping complicates previous understandings of the two as antagonistic competitors. As this study of merchant time suggests, the period cannot simply be seen as the era which ushered in the beginnings of an ascendant clock time that dominated in the nineteenth century. Rather, the merchant capitalism which governed the British Atlantic economy operated through its own unique temporal logic that must be understood in its own terms.

Reckoning with Empire: The Board of Longitude in the Eighteenth Century

The Board of Longitude remained an idle appendage of the Navy Office for the first 23 years of its existence. Founded by Parliament through the 1714 Longitude Act, the Board and its 23 commissioners—comprised of top naval officials, astronomers, and several others personally appointed—were charged with "examining, trying, and judging…all proposals, experiments, and improvements," for finding the longitude at sea.[1] 'Discovering the longitude' was widely acknowledged as on the greatest challenges facing early-modern navigation. Yet despite an initial outpouring of public interest in claiming the massive £20,000 Parliamentary reward, no method was examined, nor scheme put to trial for more than two decades.

The Board of Longitude first met June 1737 to judge a new machine "in the nature of clock work," created by John Harrison. Harrison, a Yorkshire-born carpenter with no formal training in clockwork, had been building and repairing wooden clocks since the 1710s.[2] The Board's relationship with Harrison grew as the watchmaker developed four timekeepers over the span of 30 years, now known as the H1, H2, H3, and the H4.[3] Yet it is the rapidity of their falling out in the mid-1760s that has sustained much of the

[1] 13 Ann. C 14.
[2] Confirmed Minutes of the Board of Longitude, Royal Greenwich Observatory Archive (RGO) 14/5, p.2. For what is still the most comprehensive biography of Harrison, see: Humphrey Quill, *John Harrison: The Man Who Found Longitude* (London: John Baker, 1966). The abbreviations H1-4 come from Rupert T. Gould's foundational work on restoring the Harrison timekeepers. Gould, *The Marine Chronometer: Its History and Development* (London, 1923). For more on Gould's work with the Harrison timekeepers, see Jonathan Betts, *Time Restored: The Harrison Timekeepers and R.T. Gould, the Man Who Knew (almost) Everything* (Oxford, 2006).
[3] Institutional work on the Board itself has centered on the 1760s as the period in which the Board of Longitude 'matured' into a self-sustaining body. The clearest articulation of this comes from Katy Barrett's work on Viscount Barrington. Barrett, "'Explaining' Themselves: The Barrington Papers, the Board of Longitude, and the Fate of John Harrison," *Notes and Records of the Royal Society* 65, no. 2 (June 20, 2011): 145–62.

popular interest in the Board.

In the summer of 1765, the Board began to look beyond Harrison's H4 chronometer for other solutions to the longitude problem. Despite seemingly successful trial voyages to the West Indies, the Board declined to grant Harrison any certificate that would authorize him to collect the £20,000 reward. Instead, the commissioners decided to adopt a lunar distancing method first proposed by Isaac Newton and brought into fruition by the German astronomer, Tobias Mayer, who had passed away two years prior. In 1766, the Board began calculating and publishing an annualized lunar table almanac under the direction of Rev. Nevil Maskelyne, himself a proponent of the lunar method going back some time. Maskelyne was regarded by Harrison as his greatest impediment to being given the reward, a feeling that was magnified when Maskelyne was named Astronomer Royal—an appointment which came with a seat on the Board of Longitude in 1765.[4]

Most scholarship on the longitude question has centered itself on the relationship between Harrison and the Board vis-à-vis Maskelyne. Commissioners of the longitude, we are told, quickly became subservient to Maskelyne's own vision of how the longitude would be found such that he was able to wield tremendous institutional influence in his competition with Harrison. Through repeated recourse to the impartiality of Parliament, Harrison was granted sums of money he believed were owed to him by the Board. By the time of his death in 1776, Harrison had received more than the Longitude Act's reward (a total of £22,550), a just recompense for his otherwise lost cause of formal recognition by the Board. Such a view of the longitude question, popularized most

[4] Humphrey Quill, *John Harrison: The Man Who Found Longitude* (London, 1966): 117.

notably by Dava Sobel in 1995, has failed to see the Board and the commissioners as anything more than side characters in a story that is ultimately about John Harrison's technical brilliance.[5]

The desire on the part of the British to find a workable method of reckoning a ship's East-West location while at sea has similarly been shorn of its imperial dimension. Historians have long emphasized the post-1763 reforms which led to the imperial crisis and later American Revolution, most notably the Sugar and Stamp Acts of 1764 and 1765.[6] More recently, historians of imperial geography and cartography have furthered our understanding this post-war colonial policy. Their work has revealed the extent to which geospatial knowledge of the British empire was vital to the project of bringing colonies new and old under a unified political economic system.[7] That the Board has not figured in this reevaluation of space and geography is arguably a testament to the power of Sobel's narrative.

This paper suggests that there is still much to be gained by 'looking out' from the imperial core, and the Board of Longitude specifically. While scholars have increasingly demonstrated the importance of Indigenous knowledge, colonies-as-laboratories, and the transatlantic as well as transimperial networks of information exchange which sustained the learned societies of European capitals, the scope of this paper is self-

[5] Most representative of this view include Rupert T. Gould, *The Marine Chronometer, its history and development* (London, 1923); Humphrey Quill, *John Harrison* (1966); Dava Sobel, *Longitude: The True Story of a Lone Genius Who Solved the Greatest Scientific Problem of His Time* (New York, 1996). Sobel's book achieved widespread acclaim and was later adopted into the film *Longitude* (2000).
[6] Edmund S. Morgan and Helen M. Morgan, *The Stamp Act Crisis: Prologue to Revolution* (Chapel Hill, 1995); P. D. G. Thomas, *British Politics and the Stamp Act Crisis* (Oxford, 1975)
[7] Notable examples of this 'geographic turn' include S. Max Edelson, *The New Map of Empire: How Britain Imagined American before Independence* (Cambridge, MA: 2017) and Paul Mapp, *The Elusive West and the Contest for Empire, 1713-1763* (Chapel Hill: 2012).

consciously confined to an internal study of the Board.[8] This is not to deny the role of empire in the longitude question, but rather to address it from a different perspective. Few attempts have been made to understand the Board of Longitude as an institution; fewer still have sought to understand its role in the British Empire.[9] My own attempt to 'look out' from halls of the Admiralty Office is thus as much a project of unlocking the internal dynamics of the Board as it is a recognition that placing those dynamics within the context of an enlarging maritime empire is essential to a full understand of the Board itself.[10]

The minutes of their meetings are largely devoid of any overt political rhetoric; in stark contrast to the pamphlets and newspapers which routinely emphasized the importance of the longitude to British imperial and commercial success. By reading the subtle shifts in language employed by commissioners in their deliberations and

[8] Recent work on Indigenous knowledge includes: Allison Margaret Bigelow, *Mining Language: Racial Thinking, Indigenous Knowledge, and Colonial Metallurgy in the Early Modern Iberian World* (Chapel Hill, 2020); Cameron B. Strang, *Imperialism and Natural Knowledge in the Gulf South Borderlands, 1500-1850* (Chapel Hill, 2018); Julie Cruikshank, *Do Glaciers Listen? Local Knowledge, Colonial Encounters and Social Imagination* (Vancouver, 2006). On colonies as laboratories of scientific knowledge: Pablo F. Gómez, *The Experimental Caribbean: Creating Knowledge and Healing in the Early Modern Atlantic* (Chapel Hill, 2017); Londa Schiebinger, *Plants and Empire: Colonial Bioprospecting in the Atlantic World* (Cambridge, MA, 2007); Richard H. Grove, *Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism, 1600-1860* (Cambridge UK, 1996). On networks of exchange see: Paula Findlen, ed., *Empires of Knowledge: Scientific Networks in the Early Modern World* (New York, 2018); James Delbourgo and Nicholas Dew, eds., *Science and Empire in the Atlantic World* (New York, 2008).

[9] This is all the more surprising given the range of scholarship on the successor to the Board of Longitude, the Hydrographic Office, which was founded in 1795 and assumed the Board of Longitude's responsibilities when it was dissolved in 1828. See: Megan Barford, "D.176: Sextants, Numbers, and the Hydrographic Office of the Admiralty," *History of Science* 55, no. 4 (December 2017): 431–56; D. Graham Burnett, "Matthew Fontaine Maury's 'Sea of Fire': Hydrography, Biogeography, and Providence in the Tropics," in *Tropical Visions in an Age of Empire*, ed. Felix Driver and Luciana Martins (Chicago, 2005), pp. 113–134; Jordan Goodman, *The Rattlesnake: A Voyage of Discovery to the Coral Sea*, (London, 2005); Eric Tagliacozzo, "Hydrography, Technology, Coercion: Mapping the Sea in Southeast Asian Imperialism, 1850-1900," in *Maritime Empires: British Imperial Maritime Trade in the Nineteenth Century,* eds. David Killingray, M. Lincoln, N. Rigby (Rochester, 2004): 142-158.

[10] This perspective is informed by recent calls for 'thinking the empire whole' as it relates the institutions which supported the British Empire. Steven Pincus, Tiraana Bains, and A. Zuercher Reichardt. "Thinking the Empire Whole." *History Australia*, December 20, 2019.

resolutions, one sees that the Board of Longitude actively sought to refashion itself to meet the navigational demands of the British Empire.

By looking out from the perspective of the Board, this essay seeks to demonstrate how changes in the Board's understanding of its own mandate evolved in light of imperial expansion. Shifts in how the Board spoke of the 'practicability' of proposed solutions to the longitude problem, particularly in its dealings with John Harrison, reveal how imperial integration and consolidation quickly became a primary concern for the commissioners as a result of the Seven Years War. Whereas the Board had previously read the longitude problem as one of narrow technics, commissioners increasingly recognized that any method of finding the longitude had to be suitable for the entirety of Britain's maritime factors.

By the seventeenth century, mariners could reliably establish their latitude (the North-South position) by comparing the angle of the mid-day Sun to an object on the horizon against astronomical charts. They did this using a backstaff (so named because the user had to have their back to the sun) first developed in 1594 by John Davis. This 'Davis Quadrant' was a single mirror quadrant that at best came within five to six arc-minutes of the true latitude. This level of accuracy was generally sufficient for navigation, but such a large margin of error did result in notable shipwrecks such as the Scilly Disaster in 1707.[11]

[11] In 1707, during the War of the Spanish Succession, Admiral of the Fleet Cloudesley Shovell's squadron was returning from the failed siege of Toulon when four of the ships under his command were wrecked on the Scilly Isles, southwest of Cornwall. Poor weather and inaccurate latitudinal reckoning led Shovell to believe they were further south than they were, and over 1,400 men including Shovell died as a result of the wreck. The Scilly disaster rocked the British public as well as the Admiralty, spurring investigations into the quality of the navy's navigational instruments. See: W. E. May, "Naval Compasses in 1707," *Journal of Navigation* 6, no. 4 (1953): 405-490. Shovell's death is often erroneously characterized as a

Latitudinal observations were significantly improved by John Hadley's invention of a double mirror quadrant in 1731. Hadley's quadrant included an additional index mirror and index arm that allowed the user to focus the quadrant on a fixed position and use the indices to line up the sun. Not only was this far more accurate—improving the observations to within a single arc-minute—Hadley's Quadrant was general easier to use at sea as well.[12]

Navigators had far greater difficult fixing the longitude, the east-west position. Given the rotation of the earth, they were unable to use the position of the sun the same way they could for the latitude. It theoretically was understood that navigators could find their longitude by comparing their local noon time with the reference time of a fixed location to calculate how many hours and minutes east or west they were. Each degree of longitude is divided into 60 minutes that are then further divided into 60 seconds, and the actual length of each 'minute of longitude' is relative to the latitude. For instance, one minute of longitude at the equator is equal to 60 geographical miles. Sailors knew that if they could reliably establish the difference in time, they could use the latitude to find their longitudinal position.

But theory and practice are two very different things, and navigators instead relied on the terrifically imprecise method of longitude by account, also known as 'dead reckoning'. Using such a method, sailors would record the speed and direction of their

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failure of calculating the longitude. The origins of this myth are found in 1713 when William Whiston was petitioning Parliament to pass what becomes the Longitude Act. Dava Sobel similarly ties the Scilly disaster and the public outcry over it to the origins of the Longitude Act. Yet as May demonstrated through his reconstruction of the surviving navigation logs from other ships in the squadron, the wreck was squarely caused by their inaccurate latitudinal observations. W. E. May, "The Last Voyage of Sir Clowdisley Shovel." *Journal of Navigation* 13, no. 3 (1960): 324–32.

[12] David Landes, *Revolution in Time: Clocks and the Making of the Modern World* (Cambridge: MA, 1983): 161, Margarette F. Schotte, *Sailing School: Navigating Science and Skill, 1550-1800* (Baltimore, 2018): 95-97.

ship in order to roughly guess how far east or west they had travelled over a period of time. Unfortunately, determining the longitude by account did not factor in the crucial variables of winds and currents, which could severely disrupt their calculations.

All European empires had recognized this inadequacy, and most has established their own longitude commissioners by 1714 when the British Parliament passed an *Act for Providing a Publick Reward for Such Person or Persons as shall Discover the Longitude at Sea*.[13] The Longitude Act was designed to mobilize the British public to develop a "practicable" method of determining a ship's longitude, a discovery that would greatly improve navigational science and, as the Act noted, "be of particular advantage to the trade of Great Britain." The rewards were tiered; £10,000 were to be awarded for a solution that found the longitude within "one degree of a great circle" or sixty geographical miles, £15,000 for a solution "if it determines the same to two thirds of that distance," and the ultimate reward of £20,000 for a method of determining longitude within half a degree, or thirty geographical miles. To judge proposed solutions, the newly established Board of Longitude was given an additional £2,000 from the Navy budget that could be awarded for the "examining, trying, and judging of all proposals, experiments, and improvements," as they deemed necessary (the Board would have to reapply to Parliament for more money each time they exhausted their budget).

Yet to claim any of three rewards, the Act stipulated that any proposal, which a majority of the Board deemed "practicable and…of considerable use to the publick," had

[13] The first longitude prize was put forward by Phillip II in 1567. While it is outside the immediate scope of this paper, the tendency among historians to frame the longitude problem in purely British terms has clouded our understanding of the issue. For the longitude problem outside the British context, see: Richard Dunn, Rebekah Higgitt, ed., *Navigational Enterprises in Europe and its Empires, 1730-1850* (London, 2015).

to undergo a trial "from Great Britain to any such port in the West-Indies…without losing [the] longitude beyond the limits before mentioned."[14] From the beginning the longitude problem was intimately connected to the West Indies and transatlantic trade.[15]

With many in Parliament possessing considerable financial stakes in the West Indies, Isaac Newton was called before a committee in 1713 to discuss different approaches to finding the longitude. Newton considered three schemes at his deposition, all "true in theory," but lacking feasible methods of deploying them. The first was a watch that was able to "keep time exactly" aboard a ship. The idea of a timekeeper that could be made accurate enough to withstand the motion of a ship at sea and the variations in temperature dated back to the Dutch polymath Christiaan Huygens in the 1660s. Yet as Newton informed Parliament, "such a Watch had not yet been made" which could overcome these challenges. The second method relied on astronomical calculations of Jupiter's satellites and required a telescope the length of which ruled it out as a reasonable method aboard a ship. The third method, based on the positioning of the moon, was "not yet exact enough" in theory to calculate anything more precise than within a few degrees of longitude.[16] Nevertheless, Newton was himself partial to this third proposal, a method known as 'lunar distancing', and was confident that it would be the most likely solution.

Much like the timekeeping method, lunar distancing was a way of determining the reference time while at sea. The theory rested on creating highly accurate tables of the

[14] 13 Ann. C 14.
[15] The requirements of a West Indian trial specifically have only recently been understood by historians as a vital aspect to the history of the longitude problem. Higman, B.W. "Locating the Caribbean: The Role of Slavery and the Slave Trade in the Search for Longitude." *Journal of Caribbean History* 54, no. 2 (2020): 296–317.
[16] *Journal of the House of Commons* (JHoC), v. 17, p.677

observed distance between the moon and the sun at three-hour intervals from a fixed location, such as the Royal Observatory at Greenwich, for every day of the year. Correcting for latitudinal variation through other, pre-calculated chart books, navigators could using these 'lunar' distances, to determine the reference time of Greenwich.[17] The real challenge was in calculating accurate enough tables and, as Newton explained, the lunar distancing method was at best accurate to within "two or three degrees" of the true longitude.[18] Even when more accurate tables were produced, it was still best practice to make multiple observations and average them out; a process which all told could take upwards of two hours.

Newton's support for lunar distancing method waxed as his view of the horological solution waned. As the Lucasian Chair of Mathematics at Cambridge, he was officially one of longitude commissioners appointed by the 1714 Act. The Board would not meet until a decade after Newton's death in 1727, and his correspondences suggest that the Admiralty Office was more inclined to use Newton as an unofficial consultant rather than convene the rest of the Board. In response to a 1721 request by the Admiralty to review a proposed marine watch, Newton asserted that the longitude was "not to be found by any method by [which] it cannot be found at land." "Watch-work," he wrote, was too inaccurate an art to prove useful for such precise observational needs. His confidence in improving terrestrial astronomy—and therefore solving the longitude question—lead him to conclude that only "the ablest astronomers" were suited well enough to actually solve the question at hand.[19]

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[17] J. W. Norrie, *A Complete Epitome of Practical Navigation* (London, 1835): 222.
[18] *JHoC* v. 17, p.677.
[19] Newton to Burchett, October 1721, in Alfred Rupert Hall and Laura Tilling, eds., *The Correspondence of Isaac Newton, vol. 7, 1718-1727* (Cambridge, 1977), pp. 172-173

A draft version of Newton's letter to the Admiralty went further in outlining his view of the longitude question and the Act. "The first step," he wrote, "for putting the Act in execution should have been to consider how Astronomy might be sufficiently improved before it be applied to sea affairs."[20] Newton may have been expressing his annoyance at having to judge schemes which he understood as wholly unreasonable. As Larry Stewart has shown, Newton increasingly resented those who petitioned him directly.[21] Regardless, his desire for a more astronomically grounded Longitude Act suggests that his interpretation had ignored its imperial implications of a trial to the West Indies.

Elsewhere, Newton took an even far more pessimistic view of finding the longitude in practice. He disparagingly wrote to the Admiralty in 1725 that the imprecision of dead reckoning might be improved by the use of an hour glass, the most rudimentary of timekeeping technologies, "provided these new methods will not be too troublesome to be chearfully used by the seaman."[22] Yet lodged within his disdain for the intellect of sailors was Newton's own reading of the Longitude Act. If sailors were, by his account, too stupid to adopt even the simplest of timekeeping practices, then the challenge posed by the Act was purely a scientific one. The questions of practicability outlined by the Act thus related solely to the physical limits imposed by being on a ship; hence why the length of the requisite telescope ruled out using the transit of Jupiter's satellites and why the motions of the sea disqualified timekeepers.

This reading of the Act would have a tremendous influence on the Board's reading of both the Longitude Act and their own mandate going forward. If what was

[20] Newton to Burchett, *ibid.*, n.3
[21] Larry Stewart, *Rise of Public Science* (1992): 197.
[22] Newton to the Admiralty, 26 Aug. 1725, *Correspondence*, vii (1977): 330-31.

'practicable' was only a solution that could meet the technical demands of find the longitude at sea, then Britain would have its solution in no time. Newton was convinced that watchmaking approaches were exercises in futility and that a narrow reading of the Act would lead to greater Parliamentary support for astronomers to improve their observations. While he may have hoped that his interpretation would rule the timekeeper method out completely, in effect what he did was set the stage for future conflict. In the absence of any pronouncement from the Board, Newton's own interpretation became the accepted understanding of the Longitude Act.

When the Board of Longitude held its first official meeting on 30 June 1737, the commissioners led by First Lord of the Admiralty, Charles Wager, concluded that Harrison's clock, the H1, "may tend very much to the advantage of navigation," and awarded him £500 in order to finish the H1, a second "smaller" one, and to ready them both for a trial to the West Indies. Confident that Harrison's machines had overcome the technical challenges facing timekeepers at sea, the commissioners stipulated both timekeepers would "remain in [the Board's] possession for the Use of the Public," upon returning to England.[23] Newton may have been wrong about the possibility of a timekeeping solution, but his narrow concern for technical practicability still held sway with the commissioners, many of whom were Newtonian devotees.[24] If—and despite

[23] RGO 14/5, p.5

[24] Of the eight commissioners present at the first meeting, half of them were key figures in popularizing Newtonian natural philosophy in Britain and Europe both before and after Newton's death in 1727. They were: Hans Sloane, President of the Royal Society; Edmund Halley, Astronomer Royal; James Bradley, Savilian Professor of Astronomy at Oxford; and Robert Smith, Plumian Professor of Astronomy and Experimental Philosophy at Cambridge. For more on popular Newtonianism see: Simon Schaffer, "Newtonianism," in *Companion to the History of Modern Science*, eds. R. C. Olby, G. N. Cantor, J. R. R. Christie, M. J. S. Hodge (London, 1990): 610-27; and Laura Miller, *Reading Popular Newtonianism: Print, the Principia, and the Dissemination of Newtonian Science* (Charlottesville, 2018). Boris Hessen's

their optimism it was still a large if—Harrison's timekeepers were able to maintain the longitude during an Atlantic crossing, then the matter would be settled.

Harrison's timekeepers would not be sent on a trial until the 1760s, and the intervening decades saw the commissioners' understanding of their role in the empire evolve considerably. From their perspective, the narrow scientific reading of their mandate was rendered untenable; a consequence of the Seven Year's War. The imperial dimensions of the longitude that had existed from the beginning were increasingly rendered explicit by voices outside of the Board, with some questioning the utility of its very existence. From the 1740s onward, the commissioners steadily began to take a broader view of their mandate. General utility and practicability, terms that had previously been secondary to technical ability, were put at the forefront of the Board's thinking by the time Harrison's timekeeper returned from Jamaica in 1762.

Such concerns were well understood beyond the walls of the Admiralty Office, where interest in the longitude problem was motivated by more material concerns. In January 1741, a number of merchants, captains, and ship masters petitioned Parliament to make the funds authorized by the Longitude Act for experiments and trials payable for surveys to determine "the longitude and latitude of [Britain's] chief ports…more exactly than had hitherto been done." The petitioners recognized that longitude at sea was only part of the navigational problem. Properly "fixing" the latitude and longitude of British ports was not only a practical concern, they argued, but one that was "absolutely necessary for making the discovery [of the longitude] useful."

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seminal work from 1931 on the political economic questions that Newton sought to address additionally speaks to questions of popularization. Hessen, *The Social and Economic Roots of Newton's 'Principia'* (1971).

Parliament took the petitioners' concerns seriously, and the issue was referred to a committee comprised, in part, by "all the merchants of the house" and all those representing port towns before quickly being passed into law.[25] The resulting *Act for Surveying the Chief Ports and Head Lands on the Coasts of Great Britain…*(15 Geo. II c. 39.) repeated the absolutely necessity of determining the latitude and longitude of ports and noted that doing so alongside solving the longitude problem would extend "the security of ships," that were within the 'danger zone' of eighty geographical miles off the coast.[26]

Passage of the Survey Act soon occasioned a meeting of the Board of Longitude, their first since 1737. William Whiston, the lead proponent of the Longitude Act in 1713 who had sought to win the award through a complex network of anchored ships and fireworks, petitioned the Board for £500 in order to complete a survey of the English and Irish coasts. The commissioners were wary of granting any money to Whiston—who by now had moved from fireworks to proselytizing Jupiter's satellites as the correct longitude method—but recognized that they now served a dual purpose. The Board granted the £500 to Whiston, but stipulated that he would not, "without particular orders for so doing, put the Public to any further expence on any account," relating to his solutions to the longitude.[27] The Board was evidently less motivated by the need to chart British imperial ports than they were by getting Whiston out of their hair.

That same year, the Board was informed by the watchmaker George Graham that Harrison was prepared for a trial of the H2 (his second timekeeper) and that he was

[25] JHoC, Jan. 8, 1740, p.600.
[26] Act 14 Geo. II c. 39.
[27] RGO 14/5, p.7

requesting further funding to continue his work on a third. A petition signed by members of the Royal Society including Graham testified that both the H1 and H2, "even in their present degree of Exactness, will be of great and excellent Use, as well for determining the Longitude at Sea as for correcting the Charts of the Coasts." Moreover, they attested that, "as every step towards further exacting in a matter of such importance to the Public" was to be greatly valued, they encouraged the commissioners to grant Harrison an additional 500l.[28] The Board was inclined to continue funding Harrison but stopped short of agreeing to a trial. Britain was embroiled in the War of the Austrian Succession, and there was fear that Harrison's timekeeper could be captured by the Spanish. So instead, the H2 spent five years undergoing land trials where, according to Harrison, it was heated, cooled, agitated, and subjected to "greater violence than what it could possibly receive from the motion of a ship" caught in a storm.[29]

If the threat of war convinced the Board that Harrison's timekeepers were to be safely guarded state secrets, wartime mobilization of the British fleet showed Harrison that his clocks had to be replicable at some sort of scale if they were to be useful. When the results of the H2 land trials were delivered in 1746, Harrison made sure to mention that the H3 was going to be "something different." Notably, it would be a smaller, "more commodious" sized timekeeper that was less complex. The H3 would serve, he said, as "a better model for Workmen" so that ships could be supplied with "like machines at a cheaper rate."[30] The importance of production was evidently on his mind, but such concerns were ultimately still secondary issues for both Harrison and the

[28] RGO 14/5, p.12
[29] Gould, *The Marine Chronometer* (1923): 48. RGO 14/5, p.11
[30] RGO 14/5, p.11

commissioners. As the Board continuously stated, utility as outlined in the 1714 Act was to be established through a trial to the West Indies. Once successful, Harrison's machines would be turned over to Board for the benefit of the public. The technical challenges remained paramount.

Peacetime brought renewed interest in reforming and institutionalizing the Board. In 1753, Parliament passed a new Longitude Act designed to address the worrying state of the commissionership. Before the Board had even held their first meeting in 1737, all eight members personally appointed by the 1714 Act had died. With one-third of the 23 commissioners unable to ever attend a meeting, there were clear legal ambiguities over what constituted a majority of the Board when came time to deciding whether or not to award the Parliamentary reward. The 1753 Act resolved this issue by replacing personal appointments with officials; namely the Governor of the Royal Hospital at Greenwich, the Judge of the High Court of Admiralty, the Secretaries of the Treasury, the Secretary of the Admiralty, and the Comptroller of the Navy.[31]

The 1753 appointments were to be critical for the future of the Board and its handling of the longitude problem. While the addition of these naval and government appointees reduced the numerical influence of the scientists on the Board, such figures as the professors and Astronomer Royal in fact saw their sway over the Board increase. As a general trend, the scientific faction of the Board attended meetings far more regularly than the naval and government officials did. Moreover, the political nature of those appointments meant that even figures who were more committed in their attendance often found that they could only attend one or two meetings before being

[31] 26 Geo II. c.25

shuffled out of the positions which had put them on the Board in the first place. As a result, the enlarged and ever revolving door of naval and government commissioners routinely deferred technical judgement to the men of science who had more engagement with the Board and a deeper understanding of the longitude problem.

For Harrison, this meant that his timekeepers received continued funding throughout the 1750s. Even in 1755, when he informed the Board that he had completed the H3 but desired further assistance in constructing a watch (the H4) that he believed would be equally reliable but could be "purchased at a much cheaper rate," the Board was quick to ensure that Harrison received the necessary funding, and they continued to do so until 1761 when the watch was finally completed.[32] By then, the high turnover rate of commissioners had resulted in a greater number of imperial administrators being made aware of the particulars of the longitude problem.

In October 1761, the Board informed Harrison that his son, William, would accompany the H4 on a voyage to Jamaica. They set sail in November on board the *Deptford* bound for Madeira and were soon met with strong easterly winds. As William relayed in a letter to his father, on 8 December, the crew was convinced that they had been blown further east than the 15°. 17' recorded by the chronometer. William appealed to the Deptford's captain, Dudley Digges, assuring him that "if the Island of Porto Santo was laid down right, they must see it the next morning." The ship's crew, doubtful of William's calculations and "in want of beer," were pleasantly surprised when the island was spotted the next morning.[33] Upon arriving at Madeira, Digges learned that the *Beaver*, a ship which had left for the island ten days before the *Deptford*

[32] RGO 14/5, p.19
[33] *An Account of the Proceedings, in order to the Discover of the Longitude…*(London, 1763): 37-38.

carrying letters and instructions for Jamaican Governor William Lyttleton, had still not reached the island. When the *Beaver* did arrive three days later, it was discovered that the crew had made a similar mistake in their reckoning and judged their position to be "a good deal to the East of Porto Santo." It was only after sailing west for some time that they realized their mistake and turned back. Digges was reportedly so convinced by the accuracy of the H4, that he made William "promise him the first large watch made for sale."[34]

William and the H4 had similar success on the voyage from Madeira to Jamaica, arriving there in January 1762, and on their return to Portsmouth in March. Final calculations were completed on 2 April, showing the total error of the voyage from England and back was 28.5 minutes of longitude, equivalent to 18 geographical miles in the latitude of Portsmouth. Recalling that the highest reward stipulated a maximum error of 30 geographical miles, Harrison was confident that the H4 had won him the Parliamentary reward.[35]

First Lord of the Admiralty, George Anson, died before a meeting could be held to discuss the results, and thus left the Board without its de facto president. He was succeeded by Lord Halifax, who only chaired one meeting of the Board before being replaced at the Admiralty. That lone meeting proved consequential for the Board. Not only did they review Harrison's trial results, but Halifax and the other commissioners inaugurated changes that would see the Board begin asserting authority over and above that which had been granted by Parliament.

Desiring to offset the "great expenses in coming up to London," the Board outlined

[34] *Ibid*, 38.
[35] *Ibid,* 36.

a plan to begin paying a salary to the commissioners from Oxford and Cambridge. They further proposed to a secretary, someone to address the state of "great disorder and confusion" that the Board's papers and correspondences had been in since the first meeting. Yet rather than apply to Parliament for powers to draw on available funds from the Navy, as was their usual method of handling payments, the Board under Halifax directed that the Lords of the Admiralty petition the King directly for the money to furnish both. A year later, an Order in Council appointed the Board a secretary with a 40l. a year salary and granted the professors 15l. in expenses per meeting. As Derek Howse has shown through his painstaking work deciphering the Board's finances, neither proposal was particularly costly. By then, the Board had already awarded thousands of pounds to Harrison.[36] Of consequence was the fact that the Board had begun aligning itself with the Admiralty rather than Parliament. In matters beyond the explicit text of the 1714 Act, the commissioners had asserted an interpretation of their imperial mandate which expanded their ability to judge proposed solutions in a more effective manner.

When it came time to evaluate the H4's trial to Jamaica, the Board was skeptical that the watch had met the requirements. For one, Harrison had not provided them with the H4's going rate (how fast it ticks) until after it had returned from Jamaica. Comparing the going rate before and after the trial would have shown if the watch had gained or lost time at sea, and as David Landes notes, "An *ex post* rate is like an *ex post* prediction: it is hard to be wrong."[37] But that was not the only issue. The Board further objected to the measurements that had been calculated upon the return to Portsmouth.

[36] Derek Howse, "Britain's Board of Longitude: The Finances, 1714–1828." *The Mariner's Mirror* 84, no. 4 (January 1, 1998): 400–417.
[37] Landes, *Revolution in Time*, 165.

As William had relayed in a letter, those charged with performing the calculations found that the location at which the post-voyage latitude in Portsmouth was determine had varied from where the pre-voyage observations had been made.[38] The commissioners in the end were unwilling to grant Harrison the Parliamentary reward as they had no way of knowing whether the watch had gained or lost time, and nor were they confident that the latitudes used to find the longitude were reliable.

The majority of commissioners were still confident in Harrison and ordered that a second trial to the West Indies. While noting that the H4 had "not yet [been] found to be of such great use for discovering the longitude," the Board nevertheless regarded it as "an invention of considerable utility to the public," and agreed to pay Harrison £2,500 in two lump sums. The first portion, £1,500, was immediately awarded to Harrison with the remaining £1,000 conditional upon William's return from the second voyage. Again, the commissioners were confident that accurate results would further confirm the accuracy and utility of the H4. They stipulated that if Harrison did indeed meet the requirements for the reward, that the 2,500 would be "deducted" from the Parliamentary prize and reaffirmed that the H4 would "become property of the Public."[39] Harrison and his son were enraged that they had been denied the reward on the basis of what they regarded as technicality of dubious basis, but ultimately agreed to a second trial.

The Board's next meeting was held in February 1763 and featured a number of new faces on the Board. After the fall of the Pitt Ministry the previous year, the new Prime Minister, John Stuart, 3rd Earl of Bute, had placed a number of his political allies in cabinet positions which carried with them positions on the Board of Longitude. Of

[38] *Account of the* Proceedings, (1763): 40-41.
[39] RGO 14/5 p.38-9.

these, none were more consequential for the Board than his new First Lord of the Admiralty, George Grenville. As Treasurer to the Navy in the 1750s, Grenville had an intimate understanding of how much the Board had paid out and how little they had to show for it. Moreover, he and the other "authoritarian Whigs" had spent roughly 20 years reforming the Royal Navy. Through strict hierarchies of command and regularized maneuvers, Grenville and his faction within the party set out to create a more "successful" and "uniformly governed empire," in which austerity in the metropole was balanced out by colonial extraction.[40] For the Board, this hierarchy of command meant that their mandate to discern what was and was not viable navigational knowledge and technology would ultimately serve to the interests of the empire writ large.

With Grenville at the helm, the commissioners took up a letter they had received from Harrison informing them that he had completed some improvements to the H4 and was prepared for the second trial. While cause enough for enthusiasm, Harrison further outlined his plan to "secure[]" his watch "to the public," and stated that he was "ready to disclose and make known the principles upon which his timekeeper [was] constructed in such a manner as shall make other workmen to execute the same." This was no altruistic act. Harrison stipulated that before he disclosed the H4, he had to be given an advance of some amount by Parliament and that no other horological solution to the longitude be permitted while "the merits of his timekeeper" were under consideration by the Board.[41] The commissioners unanimously agreed, and an act of Parliament was

[40] Steven Pincus, *Heart of the Declaration: The Founder's Case for an Activist Government* (2017): 52. For more on Grenville's naval reforms see Sarah Kinkel, *Disciplining the Empire: Politics, Governance, and the Rise of the British Navy* (Cambridge: MA, 2018). On factions within the Whigs see Justin du Rivage, *Revolution Against Empire: Taxes, Politics, and the Origins of American Independence* (New Haven, 2017).
[41] RGO 14/5 p.44-46.

passed soon after which would award Harrison £5,000 upon certification that he had made a clear and full "discovery" of his watch.[42]

What seemed like a straightforward plan was immediately complicated by the Treaty of Paris. At the behest of Lord Bute, Scottish historian John Campbell published a lengthy vindication of the government's West-Indian gains from the recently signed treaty. His *Candid and impartial considerations on the nature of the sugar trade*, championed the great fortunes that Britain would quickly amass on the sugar islands of Grenada, Saint Vincent, Dominica, and Tobago.[43] Interestingly, he noted that ships bound for Barbados had been prone to miss the island, sail beyond the southern coast, and "[fall] into the hands" of French ships patrolling the Grenadines. British ships traveling to Barbados, he wrote, took pains to avoid this by tracking more circuitous routes that resulted in safer but ultimately "longer and more tedious," voyages. Campbell was likely expressing the difficulties presented by dead reckoning and attempted to disguise this navigational worry in military success. As the Treaty of Paris had confirmed the British capture of the Grenadines during the Seven Years War, concerns over French incursion into Barbadian trade routes were a thing of the past. According to Campbell, the problem to be solved, the problem that had now *been* solved, was the French not navigation.[44]

Yet no sooner was peace secured that issues of trade and longitude threatened further conflict. One of the major concessions won by the French during the negotiations

[42] 3 Geo 3. c.14
[43] John Campbell, *Candid and impartial considerations on the nature of the sugar trade; the comparative importance of the British and French islands in the West-Indies: with the value and consequence of St. Lucia and Granada, truly stated*., (London, 1763).
[44] Campbell, *Candid Considerations* (1763): 192.

were fishing rights in North America. According to Article V, French fishermen were granted access to fishing grounds in the Gulf of St. Lawrence provided that they remained at a "distance of three leagues," or nine nautical miles, from British coasts.[45] Some in France soon wondered if the wording in the treaty could be used as a pretense for future conflict. "The latitude is easily found at sea," one Parisian commentator remarked, "but as the longitude is not so well ascertained, our fishermen may often have disputes…with the English about those limits, which at length may be productive of hostile acts." To avoid such future conflict, it was suggested that the system of geographically delineated fishing rights be scraped altogether in favor of an unrestricted map where "industrious" fishers would "endeavor to undersell and circumvent each other."[46] The French understood well that their fisheries were too important and the longitude too indeterminate to leave the former to the uncertainty of the later.

Such a system was out of the question for Grenville, who was appointed Prime Minister in April 1763. With Grenville in office, Harrison and his growing supporters saw an opening to press for the Parliamentary reward before the second trial or H4's discovery had been made. One pamphlet noted the fortunate coincidence of Harrison's successful voyage to Jamaica happening "at a Time when this Kingdom [saw] Peace restored," and the empire enlarged. Solving the longitude problem, the author argued, was integral to the Grenville ministry's plan of reforming the institutions of imperial governance. "A Discovery which conduces to the safety and dispatch of Sailing," the pamphlet maintained, "could never be more acceptable, than when our Fleets cover and

[45] Article V, Treaty of Paris 1763. As stipulated in Article VI, the French would retain possession of the islands of St. Pierre and Macquelon, "to serve as a shelter to the French fishermen," provided that they took no steps to fortify them. https://avalon.law.yale.edu/18th_century/paris763.asp.
[46] "Extracts from a Letter from Paris, July 29," *London Evening Post* no. 5580, Aug. 6-9, 1763: p. 5

command the Seas; and which enables us to ascertain the Geographical Situation of Headlands, Ports, and Havens, when our Dominions are extended to Regions, to us before this Time almost unknown."[47] Holding back this tremendous advancement was not Harrison, the argument went, but the longitude commissioners who were more concerned with maintaining their government stipends that actually solving the problem. Not only bureaucratic waste, the author pinned the recent shipwrecks of the *Litchfield*, *Ramilies, Humber*, and the *Doddington* Indiaman—"mistakes of longitude, arising from the defects of the methods now in use"—squarely on the Board's refusal to act. Campbell's implicit argument against the longitude problem was additionally reworked into a pro-Harrison attack. While the £20,000 reward was substantial for a government facing a post-war budgetary deficient crisis, the author contended that it was "a meer trifle" when compared with the money to be made by shorter and safer voyages.[48]

The Board thus faced a new set of concerns. While Harrison's machines had proven that the timekeeping solution to the longitude was indeed feasible, it was still unclear as to when the Board would receive any instructions on how they were constructed. Added to this were the imperial questions posed by the Treaty of Paris, which would require the Board to take far larger view of their mandate to review proposals than they had been previously operating with. The Board continued to grow increasingly sensitive to issues of cost and general use under the Grenville ministry; questions which had only begun to surface in earnest after the H4's voyage to Jamaica. With ambiguities abound, all looked ahead to the second trial.

[47] *Account of the Proceedings,* (1763): 1-2.
[48] *Ibid*, 3.

Preparations for the Barbados trial reveal the extent to which the Board had internalized the imperial dimensions of their mandate. As the British Empire had been substantially enlarged by the Treat of Paris, it was incumbent upon them to determine which longitude method would rule the waves. How they would come to that determination proved to be critical. The commissioners' interpretation of general utility had fully evolved into an imperial reading of the 1714 Act by the time they met to consider the Barbadian trial results. What Harrison interpreted as favoritism and goalpost shifting on the part of the commissioners in denying him the Parliamentary reward was instead the culmination of the Board's turn towards the empire *in toto.*

Throughout the Summer and early Fall of 1763, the Board worked alongside mathematicians at the Royal Society to develop a comprehensive plan for trialing Harrison's watch and the lunar method. With no room for error, the commissioners set out to avoid the issues of the first trial. They stipulate that Harrison was to deliver a signed and sealed account of the H4's going-rate before William set sail and elected to send Maskelyne and his assistant, Charles Green, to the West Indies months ahead so that they would have ample time to determine the fixed longitude of Jamaica.[49] Yet no sooner was the matter settled that the commissioners took up a letter given to them by the Secretary for German Dominion Affairs. The University of Göttingen had requested payment to the widow of the now deceased Tobias Mayer for Maskelyne's publication of his lunar tables earlier that year. The Board resolved that in order for any payment to be made, the tables had to be given an official trial by the Board, and so Maskelyne was further charged with "mak[ing] observations of the Moon's motions," to test the tables'

[49] RGO 14/5, p.56-7, 59.

accuracy.[50] Maskelyne, who was not present at the present at the meeting, was called before the Board a few days later and informed the commissioners that he could not travel to Jamaica on account of concerns for his health, but was willing to go to Barbados instead. As Maskelyne had had previous experience with the tables, the Board was determined to have someone skilled at taking the measurements testing the lunar method. The commissioners agreed that the H4's second trial, and the lunar's first, would be to Barbados.[51]

Maskelyne left for Barbados in September on board the *Princess Louisa*, reaching the Madeiras in the first week of October before continuing on to the West Indies.[52] Maskelyne and Green landed in Bridgetown in early November and began taking observations on 13 November. The two moved to a newly built observatory in January 1764 where they took a total of 29 observations before departing for England in August.[53] In the midst these observations, William and the H4 set sail on the *Tartar* and reach the Madeiras in April. Despite harsh weather in the Bay of Biscay, the ship's captain certified that the H4 had maintained the longitude and correctly directed the *Tartar* to Porto Santo.[54] William arrived in Bridgetown on 13 May to find that the trial had "engrosse[d] a great deal" of the island's white elite population, many of them hoping to hear of either methods' success. To their dismay, they were still "in the dark" when

[50] RGO 14/5 p.53.
[51] RGO 14/5 55-6.
[52] Logbook of the voyage to Barbados, Papers of Nevil Maskelyne. RGO 4/321, p.16, 28.
[53] Nevis Maskelyne, "Astronomical Observations Made at the Island of Barbados; At Willoughby Fort; And at the Observatory on Constitution Hill…," *Phil. Trans. Roc. Soc.* v.54 (1764):389-392.
[54] John Harrison, *A Narrative of the Proceedings Relative to the Discovery of the Longitude at Sea…subsequent to those published in 1763* (London, 1765) *Barrington Papers*, RGO [hereafter BGN] 14, p.7

William left the island in early June.[55]

The raw observation data from both the H4 and the lunar charts was presented to the Board in September, along with the sealed going-rate calculations and the most recent longitude observations taken at the Royal Greenwich Observatory. The commissioners appointed an independent three-man body of navigators and astronomers to review all the data and calculate the results for both methods.[56]

News that the Board had begun their calculations quickly turned into public debate over the utility of Harrison's watch. Despite his promises to do so, Harrison had not yet revealed the H4's construction to the public. Only he and those he worked with had such an understanding. This shroud of secrecy brought about speculation over how much the watch would cost. Accounting for the technical mastery required to replicate it, one writer estimated that it would cost 100l. per watch, a price five-times that of "every common watch," made by the most respected watchmakers of London. Harrison's inaction elicited charges that he was "gaping for the mammon" with little actual concern for the magnitude of the longitude problem. It was suggested that he be given a just reward, "but not to be considered as the reward by Act of Parliament, since…it answers not the general purpose intended." Giving him the Parliamentary award, it was argued, would deprive it from some other, "more useful, practical, and less expensive method."[57]

Others still doubted how accurate any such potential replicas would be. The astronomer Samuel Bamfield wrote to the *London Chronicle*, stating that even "if ten

[55] *Lloyd's Evening Post*, 18-20 July 1764, p.6.; 1-3 August 1764, p.3
[56] RGO 14/5, p.62-4.
[57] *Lloyd's Evening Post*, 12-14 September 1764, p.8

thousand thousands of *Mr. Harrison's Automata* were immediately made," it did not stand to reason that any of them would be as accurate as the watch which had gone on trial. As Bamfield noted, Harrison had spent "so many years" bringing the H4 to its current state that it would be unreasonable to expect that level of technical precision for every watch, regardless of how many watchmakers were employed to make them.[58]

With debate swirling, the trial calculations were returned to the Board in January 1765, by which time Maskelyne had been appointed to replace the recently deceased Nathaniel Bliss as the Astronomer Royal. The results showed that both methods had maintained the longitude within the limits set by the 1714 Act, but a review of the Board's finances revealed that the commissioners had spent the last of their most recently allocated £2,000 on the voyages to and from Barbados. On the first point, the Board elected to postpone their assessment of the trial until more commissioners could be present. More importantly, they determined that in order to pass any judgement the Board would need more money and "fresh powers" from Parliament that would allow them to grant the Parliamentary reward to anyone else who had solved the longitude "by any other method than that invented by Mr. Harrison."[59] The Board decided to have Viscount Barrington, one of the most active of the government-appointed commissioners and a highly regarded public orator, make their case before the House.[60]

When the Board of Longitude reviewed the calculations of the Barbados trial on 9 February 1765, the commissioners used their mandate to force open the issue of production. They simultaneously affirmed that the H4 had kept time "with sufficient

[58] *The London Chronicle*, 8-10 November 1764, p.3
[59] RGO 14/5, p.74
[60] Horace Walpole listed Barrington as "one of the 28 best speakers in the House of Commons" in 1755. see: Barret, Explaining Themselves," p.150.

correctness," to satisfy the accuracy requirements, but noted that it was not currently "practicable and useful in terms of the said Act," nor "agreeable to the true intent and meaning thereof." The Board's resolutions dictated that Harrison had to deconstruct the watch for a group of commissioners, including fellow watchmakers Thomas Mudge and Larcum Kendall, who were charged with determining its "common and general utility[61]." Echoing the concerns of the public, the Board were determined to know how many watches Harrison could actually produce.

The lunar distancing method was met with greater interest. Maskelyne reported that on a prior voyage to St. Helena in 1761, he was able to calculate the longitude of the ship using Hadley's Quadrant to within one degree of the island's known longitude. So convinced of this method, Maskelyne stated that he published the *British Mariner's Guide*, "containing full and plain instructions for making those observations," shortly before he had left for Barbados. In addition to his own report, Maskelyne submitted letters from commanders on the East Indiamen, the *Egmont* and the *Speaker*, testifying that "the observations, taken in the method prescribed by Mr. Maskelyne, were found very useful and not difficult," in their last voyages, and that officers on the *Egmont* had found the *Mariner's Guide* "useful in the Navigation of the Ship." They recommended that if a "*Nautical Ephemeris* was published, this method might be easily and generally practised by Seaman." The Board agreed. They resolved to award £5,000 to Mayer's widow and charged Maskelyne with hiring astronomers to compile annual lunar tables so that they may be of "general utility" to British maritimers.[62]

Harrison was incensed. Unable to discern that the Board had begun to see itself

[61] RGO 14/5, p.77-8.
[62] RGO 14/5, p.80-1.

as part of Britain's imperial structure, he concluded that the Board had ignored their mandate in order to support one of their own in Maskelyne. Yet the speech that Barrington gave to Parliament give further insight into the commissioners' thinking. The results had proven that the longitude problem had been technologically overcome, but that fact would be irrelevant if it wasn't materially feasible to the great many British ships. Moreover, the Board was determined to demonstrate that funding Harrison's tinkering was not their sole reason for being.

In mid-March 1765, in the midst of a budgetary crisis and days before Parliament passed the Stamp Act, Barrington delivered his speech in defense of the Board. The issue of determining the longitude, he argued, was "a point where the honour of the nation as well as Navigation [was] so much concerned," that it necessitated the continuation of the longitude commissioners' dutiful and expert consideration. He noted that although Harrison's watch had "fully answered" the longitude problem within the "nearest limits" of the 1714 Act, the commissioners felt that more work had to be done. "If the commissioners had been certain that other timekeepers could be made…with equal exactness," he stated, the Board, "would have given him a certificate for the great reward." But no other watches had been made, and until it was shown that the H4 was more than a one hit wonder, the commissioners did not feel "justified" in giving Harrison the reward.[63]

Barrington's speech was successful, and the commissioners were granted a broader mandate. Most notable among their 'fresh powers' were the authority to make further payments to Harrison conditional upon his discovery of the H4 and the power to

[63] 'Notes for a speech to the House of Commons', BGN 8, p.1-4.

publish the illustrations and explanations given to them. Furthermore, Harrison would receive the parliamentary reward once another watchmaker had constructed a similarly accurate chronometer using the published description.[64] He was able to receive the £20,000 prize, but only on the Board's terms.

The Board's relationship with Harrison quickly deteriorated. In response to their request for comment on how to carry out the discovery of the H4, Harrison wrote to them in hopes that "I am the first, and, for my country's sake, shall be the last that suffers by pinning my faith on an English Act of Parliament."[65] At the end, Harrison could not image a reading of the Longitude Act beyond that which Newton had put forward some 40 years earlier.

The Board did eventually receive Harrison's descriptions and drawings, and they quickly sought ways to generalize production of the H4. In 1766, on the same day that he submitted them, the Board authorized a payment of £450 to Larcum Kendall to produce an exact copy of Harrison's watch, complete with "a drawing of the wheels and other parts upon a brass plate such as watchmakers usually keep for their direction." Within the next two years. Kendall was not the only watchmaker who had applied to the Board for this undertaking. Nevertheless, the Board concluded that if the H4 could indeed be reproduced at any sort of functional scale Kendall was most capable of demonstrating it.[66]

Kendall's massive task took time, and by 1767 there was mounting pressure on both Harrison and the Board to disclose how exactly the H4 worked. In January, several

[64] 5 Geo 3. c.20.
[65] RGO 14/5, p.97
[66] RGO 14/5. f.119-20, 123.

merchants and others “interested in the Navigation and commerce of [the Kingdom]” submitted a petition to Parliament requesting further clarification. They were concerned that, despite receiving “a considerable Sum of the Public Money,” Harrison had yet to publish any account of the chronometer that could “be of the least Benefit to Navigation.” Worse yet, word had spread that a French mechanic had been given privileged knowledge of how Harrison’s watch. The merchants feared that if France were to beat Britain in bringing the longitude into “general Possession,” that supremacy of British commercial interests would be threatened. The petition was referred to a committee chaired by the merchant, George Prescott, that was further comprised of all merchant members of the House as well as those holding office in the Navy.[67] The implications were clear. Even if a full explanation of the watch was slow to being made public, Parliament had to determine if Harrison’s chronometer could be produced at a scale that would satisfy Britain’s navigational needs.

In March, the Board of Longitude learned that Fernand Berthoud, a Neuchâtel-born watchmaker working for the French Navy, had indeed been told of how the H4 worked. Testifying at a Board meeting on March 14, Thomas Mudge freely admitted to discussing the watch with Berthoud at a dinner party. He noted that the language barriers between them proved difficult, but that “it might have been sufficient to have enabled [Berthoud],” to construct such a watch in England, “but not in Foreign parts.” When asked why he had disclosed the information, Mudge stated that he “thought it [his] duty” and the Board’s intention that the explanation of the chronometer should be shared. He further recalled telling a dozen or so watchmakers and “several Gentlemen

[67] JHoC, v.31 p.93

curious in Mechanics," how the chronometer worked, but added that, from the drawings Harrison had published, only "Good Mechanics may…make such Watches from them." Berthoud, Mudge concluded, was ultimately not interested in copying Harrison's "principles," as he had told Mudge that he was working on his own design.[68]

Prescott's committee additionally questioned Mudge, but his communications with Berthoud were a secondary concern. Instead, their questions focused on the utility of Harrison's published drawings; drawings which William Harrison had testified were sufficient "to enable difference Workmen to make Time Keepers…that [would] answer the Purposes thereby intended." While Mudge had previously told the Board that the drawings were sufficient for "good workmen," he nonetheless disagreed with William's characterization. Not only were the drawings alone unable to guide the general workman on accurately constructing the chronometer, Mudge told the committee that the nation at large could not produce them at the requisite scale. So "great [a] Scarcity of good Workmen in the Watch-making Business," he stated, had rendered the H4 of little "general use to the Public."[69] With that testimony, Mudge effectively ended all reasonable belief in Harrison's watch.

In 1766, Maskelyne and his team of astronomers completed their first set of tables, designed to be used the following year. The Board quickly began publishing the lunar charts in the hundreds, and in the process rendered Harrison's watches wholly insufficient by comparison. As a commissioner, Maskelyne was never entitled to the Parliamentary prize. Indeed, the reward went unclaimed until 1828 when the Board of

[68] RGO 14/5 f.145-7.
[69] JHoC, v.31 p.270

Longitude was disbanded.

In the final analysis it is easy to see the Board as failing in their mission to find an official solution to the longitude problem. Certainly, with respect to John Harrison, one might easily chastise the Board for its inability to recognize one of the most important watchmakers in history. The H4 did, after all, prove that timekeepers could be made to withstand transatlantic voyages. Yet much like Harrison, and Newton before him, seeing the Board of Longitude in such a narrow way obscures its more interesting role in the structural formation of the British Empire. From the vantage point of the Admiralty Office, the history of the Board presents a window into how imperial administrators attempted to better integrate the empire's disparate colonies over the course the eighteenth century. This evolution was most apparent following the 7 Year's War, when the Board recognized that Harrison's timekeepers were unable to meet the navigational demands of a world-spanning empire.

The Board may have been born of the British Empire, but it did not emerge cognizant of that. Realizing its role in the empire took time. More importantly, it took terrific changes to the empire for the Board to recognize what it was not. Wars and peace shook the Board of its early pretensions as a scientific prize commission. To focus on Harrison as a maligned figure in the Board's history is therefore to miss the more interesting account of how it matured into an instrument of empire.