

P24 From networks to spaces: social identities, craft knowledge and cross-cultural trade (1400-1800)

Paper title: “‘I am willing at all times to exist as the agent of communication’: the Transnational Origins of the First American Coastal Survey”

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At the close of the long eighteenth century, political concerns propelled American and European actors to measure with certainty the physical boundaries of the newly independent United States of America. The watershed effort of this trend – the famous Lewis and Clark expedition “to open up” the ‘America West’ – was sent by the United States Congress in 1804. In the years preceding this expedition, however, actors were frequently citing another name as an authority on American geography. It is perhaps a name less well known to a contemporary audience. And he was a Spaniard.

Writing to his friend John Vaughan (1756 – 1841), the treasurer of the American Philosophical Society, on 10 June 1802, the famed American geographer Andrew Ellicott remarked that:

with this I have returned the papers submitted to my examination by the A.P.S. [American Philosophical Society] and report as follows –

Mr. Ferrer’s paper contains a number of astronomical observations with the results, - the observations being made on various parts of this continent must be very interesting to the geographers and from my knowledge of the abilities of Mr. Ferrer I can have little doubt of their accuracy.<sup>1</sup>

This brief note was Ellicott’s approval of the latest observational record of José Joaquín de Ferrer, a Spanish merchant-cum-geographer, for publication in the *Transactions of the American Philosophical Society*. Far from an ephemeral influence on American geography, José Ferrer had established himself by 1802 within the scientific community centered in Philadelphia. In fact, data compiled by Ferrer had been relied upon by many early republican geographers, not least of which Ellicott, himself, during the effort to survey the southern boundary between the United States and “Possessions of His Catholic Majesty in America.”<sup>2</sup> In a letter to Thomas Jefferson in 1805, William Dunbar (1750 – 1810), another prominent figure in early American geography, remarked that he had “noted some imperfection in the position of the Walnut-hills” which Ellicott had claimed

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<sup>1</sup> Andrew Ellicott to John Vaughan, June 10, 1802, American Philosophical Society Archives (APS) Record Group (RG) IIa

<sup>2</sup> Andrew Ellicott, *The Journal of Andrew Ellicott: Late Commissioner on Behalf of the United States During Part of the Year 1796, the Years 1797, 1798, 1799, and Part of the Year 1800 for Determining the Boundary Between the United States and the Possessions of His Catholic Majesty in America* (Philadelphia: Printed by William Fry, 1814), 22, 118, 137. See also: Andrew Ellicott, “Astronomical, and Thermometrical Observations, Made on the Boundary between the United States and His Catholic Majesty,” *Transactions of the American Philosophical Society* 5 (January 1, 1802): 203–311. Ellicott refers to Ferrer’s corrections of previously accepted coordinates.

were “ascertained by Mr. de Ferrer.”<sup>3</sup> Ferrer was able to make contributions to the surveying of American territories, owing in part to the fluidity of territorial sovereignty over various regions in the late eighteenth century. In fact, the French, British, and Spanish all contested sovereignty over pieces of the region throughout the eighteenth century.<sup>4</sup> Thomas Jefferson himself noted in a previous letter to Dunbar:

While I was in Europe I had purchased every thing I could lay my hands on which related to any part of America, and particularly had a pretty full collection of the English, French & Spanish authors on the subject of Louisiana. The information I got from these was entirely satisfactory, and I threw it into a shape which would easily take the form of a Memorial.<sup>5</sup>

Indeed, Spanish and French officials spent considerable time surveying both the Illinois and Louisiana territories. In 1784 Spain closed the Mississippi River to trade by the United States, in the hope of curtailing American expansion westward.<sup>6</sup> Such fluidity of boundaries was one reason for the introduction of Spanish geographers, such as Ferrer, to American communities.

Despite early republican actor’s familiarity with José de Ferrer and his work, one could accurately say that he has been relegated to the historical footnote. Ferrer has received only minimal fame – and even then only among astronomers – as the originator of the term “corona” to describe eclipse events.<sup>7</sup> Despite his contemporary anonymity, Ferrer exercised widespread influence within the Atlantic world. This paper will draw attention to the relationship between José Ferrer and the American Philosophical Society, focusing on an epistolary exchange between José Ferrer and his contacts in Philadelphia concerning formulating a methodology for surveying the Atlantic coastline of the United States of America.

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<sup>3</sup> William Dunbar to Thomas Jefferson, December 17, 1805. Manuscript Division, Library of Congress.

<sup>4</sup> The historiography of early republican geography is a vast one, but for one recent volume which treats these competing cultures, see Paul W. Mapp, *The Elusive West and the Contest for Empire, 1713-1763* (Chapel Hill: University of North Carolina Press; Published for the Omohundro Institute of Early American History and Culture, 2011). See, as well, the contributions on entangled history in the AHR forum: Eliga H. Gould, “Entangled Histories, Entangled Worlds: The English-Speaking Atlantic as a Spanish Periphery,” *The American Historical Review* 112, no. 3 (June 1, 2007): 764–786, (accessed June 29, 2015).

<sup>5</sup> Thomas Jefferson to William Dunbar, March 13, 1804. Manuscript Division, Library of Congress. Also in the Jefferson Papers at the Library of Congress is a pamphlet arguing against the ‘Spanish despots’ and for the ‘free French’ to their American brothers in ‘liberty.’

<sup>6</sup> Gordon S Wood, *Empire of Liberty: a history of the early Republic, 1789-1815* (Oxford; New York: Oxford University Press, 2009), 113.

<sup>7</sup> The term stems from Ferrer’s record of eclipse observations taken in Kinderhook, NY: Jose Joaquin de Ferrer, “Observations of the Eclipse of the Sun, June 16th, 1806, Made at Kinderhook, in the State of New-York,” *Transactions of the American Philosophical Society* 6 (January 1, 1809): 267, 275.

José Joaquín de Ferrer y Cafranga (1763-1818) was born in Bilbao in 1763.<sup>8</sup> It is reported that he showed mathematical prowess from an early age, but nevertheless eschewed any opportunity for a scientific vocation to work for the Royal Guipuzcoan Company of Caracas as part of trade between Venezuela and peninsular Spanish markets. His mathematical skill was reawakened in 1779, however, when the sixteen-year-old Ferrer was detained in England for a year. Amidst increased hostilities between Spain and Great Britain owing, in part, to Charles III's support of the colonial rebellion against Great Britain, the British navy intercepted a commercial vessel carrying Ferrer in route to Caracas. Ferrer was transported to England in captivity where, thanks to the intervention of his father, he was permitted to enroll in a rigorous mathematics curriculum during his detention. Following his release, Ferrer returned to his work for the Guipuzcoan Company and, with this, his frequent trans-Atlantic passages. In his future voyages, however, Ferrer began to make use of the surveying, navigation, and hydrography skills he learned in England. In the course of his next trip to the Americas, in 1787, Ferrer took time to conduct various geographic observations. Soon, he was submitting observational records to European scientific societies for their consideration. In the 1790s, Ferrer spent some years in Cádiz at the Naval Observatory, working alongside Dionisio Alcalá-Galiano, Cosme de Churrua, José de Mazarredo, and other prominent naval scientists.<sup>9</sup> Despite Mazarredo's encouragement for Ferrer to abandon his commercial work and join the Spanish navy as a geographer, Ferrer continued to view his astronomical and geographical work as nothing more than a hobby.<sup>10</sup> By 1799, José Ferrer had settled in New York as part of his employment.

It was during this residency in New York that Ferrer began a decade and a half long regimen of astronomical and geographical observations of North America and the Caribbean. He took frequent trips down the Atlantic seaboard for business between New York, Philadelphia, Boston, Cuba, and New Spain. In addition, throughout his time in America, Ferrer maintained a diverse, trans-Atlantic network of correspondents to whom he sent his observational notes and from whom he received parallel observational

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<sup>8</sup> Despite his extensive travels and publication record, Ferrer has not been the object of much scholarly interest. For biographical information, see Javier Arbués Villa and Guillermo Fatás Cabeza, eds., "Ferrer y Cafranga, José Joaquín," *Gran Enciclopedia De España* (Zaragoza, España: Enciclopedia de España, 1990); Antonio Alcalá Galiano, *Biografía del astrónomo español Don José Joaquín de Ferrer y Cafranga* (Madrid: Imprenta de J. Martín Alegría, 1858).

<sup>9</sup> The establishment of a research community in Cádiz was described in Chapter Four. See, as well, Antonio Lafuente and Manuel Sellés, *El Observatorio de Cádiz (1753-1831)* (Madrid: Ministerio de Defensa; Instituto de Historia y Cultura Naval, 1988); María Dolores González-Ripoll Navarro, "La Formación Académica y Práctica de Los Marinos del Siglo XVIII: Cosme de Churrua (1761-1805), un Oficial Científico," in *De la ciencia ilustrada a la ciencia romántica: actas de los II jornadas sobre "España y las Expediciones en América y Filipinas"*, ed by. Alejandro Díez Torre, Tomás Mallo, and Daniel Pacheco Fernández (Madrid: Ed. Doce Calles, 1995), 312–323.

<sup>10</sup> Galiano, *Biografía del astrónomo español Don José Joaquín de Ferrer y Cafranga*, 12–13.

records.<sup>11</sup> Far from insignificant figures, Ferrer's correspondents during this period included such prominent figures as Jérôme de Lalande, Jean Baptiste de Delambre, François Arago, Alexander von Humboldt, and Franz Xaver von Zach. The benefits of this network of epistemic exchange may be found in Ferrer's contributions to the sixth volume of the *Transactions of the American Philosophical Society*, where he published no fewer than eight observational records.<sup>12</sup> While Ferrer claimed an interest in setting exact coordinates for American geography, an analysis of the articles' shows the more expansive nature of his observations. Alongside calculations for major points along the Atlantic seaboard, Ferrer included notes on the proper position of the Spanish borders, corrections for the locations of New Orleans and Vera Cruz, and relied on the use of parallel observations of celestial events taken by his correspondents in Greenwich and Paris as correctives for his own American data.

Indeed, a subtle but important aspect of Ferrer's geography was the placement of the United States into an Atlantic geographic dialogue. When describing the solar eclipse of 21 February 1803, Ferrer wove observations he conducted in Havana, Cuba alongside

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<sup>11</sup> Ibid., 13–14. Later in life, Ferrer would spend time in both Greenwich and Paris working with several correspondents from this period.

<sup>12</sup> Jose Joaquin de Ferrer, "Astronomical Observations Made by Jose Joaquin de Ferrer, Chiefly for the Purpose of Determining the Geographical Position of Various Places in the United States, and Other Parts of North America. Communicated by the Author," *Transactions of the American Philosophical Society* 6 (January 1, 1809): 158–164; Jose Joaquin de Ferrer, "Mémorial on the Occultation of Aldebaran by the Moon on the 21st of October 1793," *Transactions of the American Philosophical Society* 6 (January 1, 1809): 213–221; Jose Joaquin de Ferrer et al., "The Geographical Position of Sundry Places in North America, and in the W. Indies, Calculated by J. J. de Ferrer," *Transactions of the American Philosophical Society* 6 (January 1, 1809): 221–232; Ferrer, "Observations of the Eclipse of the Sun, June 16th, 1806, Made at Kinderhook, in the State of New-York"; J. J. de Ferrer, "Further Observations on the Eclipse of 16th June, 1806, Being an Appendix to No. XLIII, Page 264 of This Volume," *Transactions of the American Philosophical Society* 6 (January 1, 1809): 293–299; Jose Joaquin de Ferrer, "Observations on the Comet Which Appeared in September 1807, in the Island of Cuba; Made by J. J. de Ferrer. Continuation of the Astronomical Observations, Made by Him at the Same Place. Also the following Calculations by Him," *Transactions of the American Philosophical Society* 6 (January 1, 1809): 345–359; Jose Joaquin de Ferrer, "Notes; With Corrections, to Be Applied to the Geographical Situations Inserted from Page 158 to Page 164, in the First Part of the Present Volume of Transactions, by J. J. de Ferrer. Additional Observations on the Solar Eclipse of 16th June, 1806; By the Same. Appendix to Mémorial XXXVI: Observations of the Occultation of [ ] on October 21st, 1793; By the Same," *Transactions of the American Philosophical Society* 6 (January 1, 1809): 360–368; J. J. de Ferrer, "Astronomical Observations Made at the Havanna by J. J. de Ferrer, and Communicated by Him to the Society," *Transactions of the American Philosophical Society* 6 (January 1, 1809): 428.

Antonio de Robredo to those of Ellicott in Lancaster, Pennsylvania.<sup>13</sup> Later, Ferrer commented on his determination of the longitude of Miller's Place, along the Spanish-United States border, by comparative observations: "I have calculated fifteen observations of ingress and thirteen of egress observed in Europe," Ferrer writes, "and comparing each of these observations with the mean determination for Paris" the error of longitude for this point may be determined.<sup>14</sup> This negotiated practice, comparative measurement of solar occultation by Mercury in many locations, reasserted the value of American geographical data in European circles. For as great as the corrections that Ferrer was able to make using data from Paris and Greenwich, his correspondents wrote that they were equally impressed by Ferrer's data and its utility.<sup>15</sup> Surprisingly, the comparative methodology favored by Ferrer was strikingly different than his early republican contacts. Although relying heavily on the figures provided by Ferrer, Andrew Ellicott did not make reference to any use of European data or epistolary exchange of observational values.<sup>16</sup> While in his work, Ellicott reached across national boundaries, on occasion, to verify coordinates, he did not employ a widespread network of communication such as is found in Ferrer's corpus.

Ferrer was something of an anomaly and his peripatetic existence appears to have been exceptional for a Spanish geographer, most likely due to his status as a commercial agent and non-governmental "scientist."<sup>17</sup> Traveling observers (both geographical and

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<sup>13</sup> Ferrer, "Astronomical Observations Made by Jose Joaquin de Ferrer, Chiefly for the Purpose of Determining the Geographical Position of Various Places in the United States, and Other Parts of North America. Communicated by the Author," 161–162.

<sup>14</sup> Ferrer et al., "The Geographical Position of Sundry Places in North America, and in the W. Indies, Calculated by J. J. de Ferrer," 226–227.

<sup>15</sup> Archives Manuscrites, Bureau des longitudes, Observatoire de Paris, Manuscrits Arago, Z10, f. 23; Galiano, *Biografía del astrónomo español Don José Joaquín de Ferrer y Cafranga*, 14.

<sup>16</sup> See, for example, his articles on the Mississippi and Ohio valleys: Andrew Ellicott and R. Patterson, "Observations for Determining the Latitude and Longitude of the Town of Natchez. By Andrew Ellicott, Esq. Commissioner on the Part of the United States, for Running the Line of Demarkation between Them and the Spanish Territory. Communicated to the Society by R. Patterson," *Transactions of the American Philosophical Society* 4 (January 1, 1799): 447–451; Andrew Ellicott, "Astronomical, and Thermometrical Observations, Made at the Confluence of the Mississippi, and Ohio Rivers," *Transactions of the American Philosophical Society* 5 (January 1, 1802): 162–202.

<sup>17</sup> For one example of this argument, see María González-Ripoll Navarro, *Bajo pólvora y estrellas: Churruca y otros marinos vascos de la ilustración* (San Sebastián: Untzi Museoa, Diputación Foral de Gipuzkoa, 2000), 71–73. For more information on the Compañía, see Ramón de Basterra, *Una empresa del siglo XVIII, los navíos de la ilustración, Real Compañía Guipuzcoana de Caracas y su influencia en los destinos de América* (Caracas: Imprenta Bolívar, 1925). There are, of course, examples of similarly transient individuals who were liberated to travel in neither governmental nor mercantile contexts. See, e.g., Ana Simões, Maria Paula Diogo, and Ana Carneiro, *Citizen of the*

astronomical) had long made use of merchant networks in the Atlantic world.<sup>18</sup> While mercantile craft knowledge that related to navigation and geography was often kept secret in the sixteenth and seventeenth centuries, by the eighteenth century such information was circulating widely.<sup>19</sup> The Guipuzcoan Company, which had operated as a monopoly from its founding in 1723, disbanded after its charter was transformed into the Royal Philippines Company in 1785.<sup>20</sup> Many merchants who had operated under the banner of the Caracas trading company, including Ferrer, joined recently formed mercantile guilds in late eighteenth century Caracas. However, the increase in Ferrer's geographical output coincided with his exploration of new areas for resource extraction and to forge new mercantile relationships following the Caracas trading company's dismantling.

Ferrer's work in North America led, in 1801, to election as a member of the American Philosophical Society. Ferrer is best associated with an intimate circle centered in Philadelphia, although his name was referenced by a wide array of early republican figures in the United States. Ferrer's closest contacts in Philadelphia included John Vaughan, Robert Patterson, Andrew Ellicott, and Joseph Clay.<sup>21</sup>

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*World: a scientific biography of the Abbé Correia da Serra* (Berkeley: Institute of Governmental Studies Press, University of California, 2012).

<sup>18</sup> See, e.g., Nicholas Dew's study of two French astronomers' and they travel through the Atlantic. Nicholas Dew, "Scientific travel in the Atlantic world: the French expedition to Gorée and the Antilles, 1681-1683," *British Journal for the History of Science* 43, no. 156 (2010): 1-18. The authors of the edited volume *The Brokered World: Go-Betweens and Global Intelligence, 1770-1820* reflect time and again about the important role merchant networks play in the transfer of ideas and technologies, see Simon Schaffer et al., eds., *The Brokered World: Go-Betweens and Global Intelligence, 1770-1820* (Sagamore Beach, Mass.: Science History Publications, 2009). This argument is, perhaps, made most forcefully by Kapil Raj in his contribution, see Kapil Raj, "Mapping Knowledge Go-Betweens in Calcutta, 1170-1820," in *The Brokered World: Go-Betweens and Global Intelligence, 1770-1820*, ed by. Simon Schaffer et al. (Sagamore Beach, Mass.: Science History Publications, 2009), 105-110.

<sup>19</sup> Londa Schiebinger, "Scientific Exchange in the Eighteenth-Century Atlantic World," in *Soundings in Atlantic history Latent Structures and Intellectual Currents, 1500-1830*, ed by. Bernard Bailyn and Patricia L Denault (Cambridge, Mass.: Harvard University Press, 2009), 305; 322-328.

<sup>20</sup> Ricardo Cierbide Martinena, "La Compañía Guipuzcoana de Caracas y los vascos en Venezuela durante el siglo XVIII," *Revista internacional de los estudios vascos* = *Eusko ikaskuntzen nazioarteko aldizkaria* = *Revue internationale des études basques* = *International journal on Basque studies*, *RIEV* 42, no. 1 (1997): 65-71; Basterra, *Una empresa del siglo XVIII, los navíos de la ilustración, Real Compañía Guipuzcoana de Caracas y su influencia en los destinos de América*.

<sup>21</sup> An analysis of the manuscript collection of the APS shows that roughly half (52.6%) of the thirty Ferrer related manuscripts are discussions of his work to which he was not a party, while he acts as a referee of others' work in a quarter of the cases (26.3%). Ferrer, Patterson, and Vaughan each contributed to 47% of the records, Clay 21%, and Ellicott 15%.

This was hardly an inconsequential group of men, particularly in matters related to geography.<sup>22</sup> Patterson (1743-1824) was an eminent mathematician and served as chair of mathematics at the reorganized University of Pennsylvania beginning in 1799, where Andrew Ellicott was among his best pupils. Patterson held many offices within the American Philosophical Society, eventually became its president in 1819. In addition to his administrative and educational roles, Patterson was one of five members of the society chosen by President Thomas Jefferson to prepare Meriwether Lewis for his expedition to the Pacific Northwest with William Clark. Ellicott (1754-1820), Patterson's former star pupil, had surveyed the boundaries between various states beginning in 1784. By 1789 he was employed by the federal government to survey the northern boundaries near Lake Erie. Ellicott achieved success and fame following his commissioning by President Washington in 1796 to survey the boundary between the United States and the Spanish territory of Florida. He refused the position of Surveyor-General of the United States when President Jefferson offered it to him in 1801, eventually joining the faculty of United States Military Academy as professor of mathematics in 1813. John Vaughan came from a commercial background, much like Ferrer. In 1784, Vaughan was elected to the APS and served as its secretary, treasurer, and librarian. He gave from his own immense wealth to the society, but perhaps his greatest contributions were the personal relationships between prominent figures that resulted from his frequent dinner parties. Joseph Clay, lastly, is frequently cited in the records related to this group of men but appears to have been little more than an affluent armchair mathematician. It was within this smaller circle that the coastal survey effort was fostered.

A month after Albert Gallatin wrote to Robert Patterson suggesting the need to develop a methodology to accurately and quickly survey the coastline of the United States, there had been no response. Indeed, the call fell on deaf ears. Was there no one, these prominent figures wondered, qualified to assist in this project? Given José Ferrer's familiarity to the circle of mathematicians and geographers associated with the American Philosophical Society, it was hardly surprising that John Vaughan thought to forward the call to him.<sup>23</sup> In response, Ferrer quickly sent a brief-but-detailed plan to Vaughan for the society's consideration.

Ferrer suggested dividing the project into three distinct phases in a methodology strikingly similar to that adopted by Vicente Tofiño for the *Atlas marítimo de España* a

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<sup>22</sup> For brief biographical sketches of these correspondents, see James J. Tattersall, "Patterson, Robert," *American National Biography (ANB)* (New York: Oxford University Press, 1999); Whitfield J. Bell, "Vaughan, John," *ANB* (New York: Ox, 1999); Silvio A. Bedini, "Ellicott, Andrew," *ANB* (New York: Oxford University Press, 1999); Joel D. Treese, ed., "Clay, Joseph," *Biographical Directory of the American Congress, 1774-1996: The Continental Congress, September 5, 1774, to October 21, 1788, and the Congress of the United States from the First Through the 104th Congress, March 4, 1789 to January 3, 1997* (Alexandria, VA: CQ Staff Directories, 1996).

<sup>23</sup> Ferrer noted receiving the notice from Vaughan on 13 April, 1807, see Ferrer to J. Vaughan, April 25, 1807, APS RG III. For the original call to develop a methodology, see Albert Gallatin to Robert Patterson, March 25, 1807, APS Miscellaneous Manuscripts (MM).

decade earlier.<sup>24</sup> The Academy of Naval Cadets and associated Naval Observatory in Cádiz were the site of a profound reform and the development of corps of scientifically elite naval officers. It was there that the Caroline Spanish Navy was created and a standard of practice that defined late eighteenth century Spanish geography. Drawing on British, French, and Dutch manuals, predominantly, curricular development at the Academy of Naval Cadets had forged a hybrid practice of surveying. Ferrer's application of this methodology to the American problem was surely not what the reformers had in mind when Francisco Gil y Lemos wrote:

From here [the Academy at Cádiz] the most outstanding may leave on important commissions of this kind, the determination of longitude in various parts of the peninsula, and correcting these things, constructing accurate charts, boundary demarcation, surveying general maps of the kingdom and its provinces, and growing their numbers could be sent with similar commissions to America, so that anything relating to the positions of those seas and coasts, and acquiring comprehensive data on meteorology of climate, general winds, and necessary precautions, leads the perfection of our navigation.<sup>25</sup>

Tofiño, Gil y Lemos, and others in Cádiz had dreamed of advancing Spanish interests through scientific advancement. Ferrer's use of their methods to advance the national interests of the United States was certainly an unexpected extension of that mission.

In the first phase of the surveying methodology observers would set thirty principal reference points and measure their location with the utmost accuracy. Secondly, teams would measure significant intermediate points in reference to these thirty stations. Finally, teams would survey the remaining inlets and capes that dotted the coastline and were out of sight from large vessels.<sup>26</sup> Beyond this three-phase process, Ferrer was also insistent that each team be supplied with proper instrumentation. He defined this to be:

A reflecting circle with two telescopes, or in lieu of it a quadrant;  
Two theodolites to measure horizontals & vertical angles;  
Two chronometers of superior quality;  
One pocket chronometer of the 2<sup>nd</sup> class;  
Two azimuth compasses – a chain to measure bases;  
A meridian notable telescope;  
Two circles of reflection, on pedestals, with their artificial horizons of mercury, or if they cannot be had two sextants with artificial horizons.<sup>27</sup>

Once the teams – a hundred Ferrer estimated would be needed – were properly equipped, he suggested that the effort begin in Philadelphia where the instruments could be properly synchronized to the observatory of the society.<sup>28</sup> Further, there was no need for the

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<sup>24</sup> Vincente Tofiño de San Miguel, *Atlas Marítimo de España* (Madrid, 1789).

<sup>25</sup> Francisco Gil y Lemos, "Plan de estudios de matemáticas", 1783, AMN Ms. 1563, doc. 3 (folio 5-11), Archivo Museo Naval.

<sup>26</sup> Ferrer to J. Vaughan, April 25, 1807, APS RG III, f.1

<sup>27</sup> Ibid.

<sup>28</sup> Ibid., f.1v.



society to send its members, Ferrer argued, because skilled laborers given proper directions could perform the measurements satisfactorily. Once their data was collected, the learned members of the society could create maps from them. This application of unskilled labor to data collection mirrored methodological decisions used during the Catastro de Ensenada, an effort that Spanish naval officers acknowledged as influential for their surveying curriculum at the academy in Cádiz.<sup>29</sup> From Philadelphia, teams would work their way up the coast during the first phase, stopping to make observations at: Cape Henlopen, Namegal, New York, Sandy Hook, the eastern end of Long Island, and “so on the whole length of the coast.”<sup>30</sup>

Ferrer noted that the accuracy of the first phase would rely entirely upon constant correcting of the chronometers and telescopes. Corrections were to be made every eight days, according to Ferrer, in order to guarantee exactness. Still, he felt that the observational record would also allow for good comparisons, especially in the major port cities: “It may be further remarked that the Longitude of Philadelphia, New York, & Cambridge, relative to the European observatories, are determined with considerable accuracy & afford to many points of comparison.”<sup>31</sup> Lastly, the first phase was to be defined by an ever-ongoing process of observation. Between each of the thirty principal stations, observers should “mark the principal points on the coast, determine often the soundings by course & distance – observe the Latitude & Longitude at sea if circumstances permit, in order to correct the determined points by estimations, & lastly to form a comparison with the distances of the stations.”<sup>32</sup>

In the second phase, Ferrer suggested that intermediate points between the thirty principal stations should be measured and marked on sketch maps. Whenever possible, Ferrer suggested that two angles be taken for setting these points to increase accuracy. Use of this method of overlapping arcs of observation was common with the French, British, and Spanish navies at this time. This method called on ships to dispatch two observers in small craft and set off a signal aboard the major vessel to allow for simultaneous observation of the reference point along the shoreline. This phase was also defined by the careful study of the entrance to ports, which, as Ferrer notes, “require without doubt very particular attention.”<sup>33</sup>

The third phase of Ferrer’s plan would require careful observation of each final detail, break, and inlet along the coastline. For this to be accomplished, Ferrer felt that “chronometers are indispensable, as without them it would be impossible, with safety to navigators, to fix more points which are out of sight of the coast.”<sup>34</sup> Ferrer’s letter to

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<sup>29</sup> Joseph de Mazarredo, “Plan de estudios”, June 17, 1783, AMN Ms. 1563, doc. 5 (folio 17-21), Archivo Museo Naval; Gabriel Ciscar, “Plan de estudios para los oficiales agregados a la compañía de Guardias-Marinas” (Cartagena, España, October 10, 1785), AMN Ms. 2141, doc. 10, Archivo Museo Naval; Concepción Camarero Bullón, “La cartografía en el catastro de Ensenada, 1750-1756,” *Estudios geográficos* 59, no. 231 (1998): 245–283.

<sup>30</sup> Ibid.

<sup>31</sup> Ibid., f.2

<sup>32</sup> Ibid.

<sup>33</sup> Ibid., f.2v

<sup>34</sup> Ibid.

Vaughan also spoke to his familiarity and struggles of setting coordinates along this coastline, adding that he could not favor a method of triangulation for this particular purpose, as it would work in theory but fail in practice. “It has appeared to me that to depend upon finding the stations solely by a series of triangles would be attended with considerable difficulties on account of the particular flatness of the coast & frequent interruption of swamps and woods.”<sup>35</sup>

Vaughan forwarded the plan to Albert Gallatin, who had conceived of the effort to survey the coastline, and enthusiastically supported Ferrer’s plan as optimal. However, Vaughan was forced to admit the challenge of employing Ferrer to oversee his plan should it be accepted:

[H]is plans of business would render it impossible for him to attend to it as far as I can learn without discretely questioning him was this not the case. His attachments to these objects would make it a desirable one to him not in a pressuring but a scientific & honorable format of view – I am sorry that his other necessary pursuits make it useless to think of him.<sup>36</sup>

John Vaughan and the APS were experiencing the same disappoint as José de Mazarredo and the Spanish navy: Ferrer was simply too transient. Ferrer was willing, however, to aid in the enactment of his plan. Vaughan offered in his letter to Gallatin that “whilst in the country he will give any information in his power to yourself or person employed & I am willing at all times to exist as the agent of communication.”<sup>37</sup> All this was for naught, however, as the survey plans dragged along owing to financial shortfall, lack of suitable instrumentation, and organizational dysfunction. The survey would not be conducted until 1816, when Ferdinand R. Hassler, whom Robert Patterson named director of the effort, was finally scheduled to begin the survey.<sup>38</sup> The final surveying methodology remained reminiscent of Ferrer’s initial suggestions.

The proposal forwarded by Ferrer appears derivative of Spanish surveying methodologies taught to naval cadets at the Naval Academy in Cádiz, an institution with which Ferrer also may be associated. Derivative of early modern pilotage, such hydrographical methodology combined practical mathematics with navigational assessment of coastal inlets. In providing a concrete vision of the eastern seaboard of the United States, Ferrer helped to define that space. Indeed, American actors utilized his methodology, interpreting their own coastline much like Spanish naval cadets across the Atlantic were taught to chart the Iberian coasts.

In 1813, José Joaquín de Ferrer moved to London to work at the British Royal Observatory in Greenwich and the following year to Paris to work with the National Institute of Sciences and the Board of Longitude. At the end of 1814, Ferrer was named director of the Spanish observatory, prompting his return to Cádiz. He died in Spain soon after at the age of 54.

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<sup>35</sup> Ibid., f.3

<sup>36</sup> John Vaughan to Washington, Albert Gallatin, April 28, 1807, APS RG III

<sup>37</sup> Ibid.

<sup>38</sup> For correspondence regarding the coastal survey between Hassler and Patterson, see Robert M. Patterson Papers, American Philosophical Society.