

A Jane of all Trades:

Janet Taylor's Contributions to Victorian Navigation

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ABSTRACT

Janet Taylor used her educational background to move fluidly between the private sphere of Victorian England, which largely confined women to domestic duties, and the male-dominated and commerce driven public sphere. Using her unique educational background, and the industrial revolution happening around her to her advantage, Taylor was able to adjust the calculations used to find position at sea based on the premise that the earth is spheroidal rather than spherical. This mathematical breakthrough would allow Taylor to establish herself as a reputable name in navigation (a male-dominated field) during the mid-nineteenth century. She would open two navigational academies, publish dozens of books, and invent or adjust numerous types of nautical equipment. Her roles as an educator, author, and instrument maker would have a wide impact on both seamen and European royalty. Her influence and narrative, however, is largely missing from navigational and maritime historiographies. This thesis will begin to fill that gap, proving that physical experience aboard ships was not the sole determinant of one's influence on the maritime community.

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GENERAL AUDIENCE ABSTRACT

Janet Taylor, a woman who made major contributions to Victorian navigation, is representative of a large historiographical gap in maritime and nautical histories. In these fields historians are typically inclined to look at famous men in navigation: John Hadley, John Campbell, and others who invented nautical instruments such as the octant and sextant. However, we have failed to contextualize the significant women who have innovated maritime practices throughout history. Taylor, for example, adjusted calculations for locating positions at sea according to the realization that the shape of the earth is not spherical, but spheroidal. She conveyed this new mathematical principle to the maritime community of London through the classes she taught at her nautical academies, the dozens of books she would publish, and the navigational tools she invented or innovated. Her multiple careers, and her success in each of them, were varied and far-reaching, making her truly a Jane of all trades. Her success as a woman in a male-dominated field was largely dependent on the industrial spirit of the nation and time in which she lived. As the industrial revolution created a need for advancement in technology and navigation, gender norms and the public/private dichotomy of Victorian England began to blur.

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Introduction

Not all nautical and navigational innovators throughout history were men. Janet Taylor, a woman who made major contributions to Victorian navigation, is representative of a large historiographical gap in maritime and nautical histories. In these fields historians are typically inclined to look at famous men in navigation: John Hadley, John Campbell, and others who invented nautical instruments such as the octant and sextant. However, we have failed to contextualize the significant women who have innovated maritime practices throughout history. Taylor, for example, adjusted calculations for locating positions at sea according to the realization that the shape of the earth is not spherical, but spheroidal. She conveyed this new mathematical principle to the maritime community of London through the classes she taught at her nautical academies, the dozens of books she would publish, and the navigational tools she invented or innovated. Her multiple careers, and her success in each of them, was varied and far-reaching, making her truly a Jane of all trades.

Janet Taylor was born with the name Jane Ionn in May of 1804 in Durham County, England. Her mother died when she was young, and until the age of nine her father allowed her to study at a school consisting only of male students at which he taught navigation, among other subjects. This is where Taylor's life diverges from that of her typical, middle-class female counterparts; the first instance in which she skirts the patriarchal line of Victorian England. At age nine, Taylor received a scholarship from Queen Charlotte and completed her final years of childhood education, first at the Royal School for Embroidering Females at Ampthill and then at a boarding school in London. This unique childhood education would frame the entirety of

Taylor's working life, providing her with the necessary abilities and opportunities to develop a reputable business of her own.

By 1831 Taylor has opened her first nautical academy, named the George Taylor Nautical Academy for her husband. In 1833, she would begin her career as an author with the publication of her first book. She would open another academy in her own name, Mrs. Janet Taylor's Nautical Academy, in the late 1830's. Between the 1830's and 1860's, she authored and published dozens of works and developed nautical technologies such as octants, sextants and the mariner's calculator. Not only would these be sold by Taylor in her own establishment, they would be showcased at large public exhibitions or developed specifically for members of royal families. The Admiralty did recognize Janet Taylor for her work near the end of her life, providing her with a Civil List Pension of £50 a year.

Taylor's work was well received and highly regarded, by both the common mariner and significant maritime organizations at large. In addition to consistent praise from navigational and maritime publications, Taylor's business would be promoted and respected by the Admiralty, Trinity House, East India Company, members of the royal family, and even astronomical observatories throughout Great Britain. All of these institutions recognized the fact that this academy was operated by a woman, but Taylor's expertise and talents were valuable to these institutions during this specific period because of the necessity for rapid expansion in Britain's navigational pursuits, a part of the industrial revolution experienced globally throughout the nineteenth century. This technologically and forwardly focused climate stems from the eighteenth century trend of "enormous, ambitious projects", many of which were centered in the maritime community. Peter Moore conveys this through using the naming and building of the *Endeavour* in the 1770's as an example. Moore describes the foundations of the industrial

environment in which Taylor was able to flourish: “Britain was a country burning with purpose; and from her fire was flung a spark, a spark that travelled further than any had ever done before. It emitted a glowing, scorching light. Only it wasn’t a spark at all. It was a ship”.¹

In addition to the Industrial Revolution happening within the nation, Taylor was also working in a society concerned with economic and imperial opportunities across the ocean. With the end of the Napoleonic Wars came an expansion in England’s use of ships and navigational practices for economic purposes; “The peace of 1815 ushered in an era when the British Merchant Service found itself in almost total control of the world’s trade routes, which had earlier been opened up by the Royal Navy”.² A rising need to advance society through technology and travel created an environment in which Taylor could flourish, impacting the maritime community and its practices without her gender and upbringing being completely confined to the patriarchal boundaries and societal norms of the mid nineteenth century.

This thesis will argue that Janet Taylor was able to negotiate the patriarchal boundaries, or the public and private spheres, of Victorian England by utilizing her talents as an astronomer, a writer, and an educator to create business opportunities for herself. She was able to navigate and move fluidly between these spheres because of the nature of the industrial revolution and global expansion happening around her, which created a rapid need for new technologies as Britain expanded its reach, both commercially and militarily. This work will also argue that the unique educational circumstances of her youth, which began with her father, served as a catalyst for her influential careers. In defining the patriarchal boundaries of the Victorian era, Deborah Gorham’s 2012 book *The Victorian Girl and the Feminine Ideal* proves incredibly useful. Using

¹ Moore, Peter. To be published. *Endeavour: The Ship That Changed the World*. Farrar, Straus and Giroux. 432 pp. 7-9.

² Jeans, Peter D. *Seafaring Lore and Legend: A Miscellany of Maritime Myth, Superstition, Fable, and Fact*. International Marine/McGraw Hill. 2004. 87.

the concept of a public and a private sphere, Gorham claims that “the creation of a sharp division between the private world of home and the public world of commerce, professional life and politics, had a profound impact on the way in which women were perceived in the Victorian period”.³ Women within this spherical system were expected to occupy the private sphere, or to operate under a “cult of domesticity”, in which “the ideal woman was willing to be dependent on men and submissive to them, and she would have a preference for a life restricted to the confines of the home”.⁴

In the context of the mid nineteenth century, Taylor was an anomaly, a woman working in a sea of men, and gaining nothing but respect and credibility for it. I will examine both her childhood education (which allowed her entrance into the field of navigation) and the institutions she opened in order to educate Victorian mariners. I will also examine her other works, and the ways in which others in her fields received them, in terms of her career as an astronomer and a writer. An examination of her nautical instruments will highlight the industrial spirit of her society, and how she took advantage of this environment. Placing her work within these three contexts will reveal how vast the scope of her influence was on Victorian mariners and navigational methods. Revealing the innovative and influential contributions Taylor made to Victorian navigation and maritime practices opens up one question: why has she not been given due credit by historians?

Education was crucial to the successes experienced by Taylor throughout her life because it served as an avenue for Taylor to utilize her talents and ultimately impact her field. It was her

³ Gorham, Deborah. 2012. *The Victorian Girl and the Feminine Ideal*. New York. Routledge Library Editions: Women’s History. 238 pp. 4.

⁴ Gorham, Deborah. *The Victorian Girl and the Feminine Ideal*. 4.

father, and the school he taught navigation at that first allowed her to exhibit her talents as an astronomer and mathematician, which gained her admittance into a prestigious academy endorsed by Queen Charlotte. Taylor would use her education to create a business for herself as an educator, using her own funds and without the help of her husband, George Taylor. The first nautical academy opened by Taylor in 1835, the George Taylor Nautical Academy, became so influential that it was “recommended by the Admiralty, Trinity House (the establishment responsible for the nation’s lighthouses) and the East India Company”.⁵

Her second nautical academy, named after herself, would become even more popular than her first. While being an educator was not an uncommon role for Victorian women to play, for most this role was confined to the title of governess, teaching small children rather than professionals in one of England’s most important industries. Taylor, however, occupied both the public and private sphere, and was able to do so because of the educational opportunities of her youth. The first chapter of this thesis especially will rely heavily on Gorham’s framework, showing how Taylor did not fit this mold. While she did fulfill the domestic roles of wife and mother, Taylor worked professionally within the public sphere of Victorian England, and experienced great success. Perhaps this is why she was so easily able to name her second nautical academy for herself; the Mrs. Janet Taylor Nautical Academy. In addition to running her academies as its sole proprietor, Taylor would author her own books to be used as the texts for classes she taught. These publications would be distributed far beyond the walls of her classroom, and were originally inspired by astronomical concepts taught to her by her father.

It was the use of fruit as a representation of celestial bodies, a concept taught to her by her father, that led Taylor to the realization that the earth was not perfectly spherical, but rather

⁵ Bruck, Mary. 2009. *Women in Early British and Irish Astronomy: Stars and Satellites*. New York:Springer Science and Business Media. 52.

spheroidal, meaning that it is ever-so-slightly elongated at the ends. This navigational breakthrough would allow for much more accurate calculations of longitude for mariners at sea. Taylor would take the mathematical and astronomical calculations used to find position at sea and adjust them according to this principle, making them much more precise than they had been previously. She would then begin writing books that conveyed this new process of calculation in a way that was accessible and understandable to the common mariner, beginning in 1833 with her *Luni-solar and horary tables: with their application in nautical astronomy; containing an easy and correct method of finding the longitude, by lunar observations and chronometers; the latitude, by double altitudes and elapsed time, the azimuth, amplitude, and true time.*

Her authorship (and career as a publisher for nautically themed books authored by others) served to showcase her knowledge and talent. An analysis of her prefaces and dedication letters reveal how she built a reputation for herself within the maritime community of Victorian London by gaining support from aristocratic figures and maritime organizations such as the Admiralty, Trinity House, and East India Company. Reviews and advertisements for her books reveal the respect she gained from the common mariner. Not only did these men trust her because notable organizations did, their accounts show that Taylor's calculations did in fact prove useful aboard ships.

Taylor would also pursue a career as an instrument maker, creating tools such as sextants, binnacles, and compasses that were better equipped to function aboard iron ships. This contribution to navigational practices would come at the most opportune time for Taylor. In the midst of the industrial revolution, there was a huge transition from wooden sailing ships to iron ships, which in turn caused new problems with using instruments to locate position at sea, particularly compasses. The mass amount of iron now present on these new ships would tamper

with the magnetic components inside traditional compasses. Knowing this, Taylor would conduct experiments on the Thames and adjust compasses, along with other tools, to get rid of this problem. These experiments, which consisted of swinging ships, would fall in line with the works of astronomers and Admiralty members also concerned with compass deviation, and would allow her to further establish herself in the field. In working with these men, Taylor was able to adjust compasses and other navigational tools, thus making mariners safer during their voyage.

Perhaps her most ambitious feat in this part of her career would be the production of her mariner's compass, which combined several navigational tools and calculations in hopes to make finding one's location at sea faster, more efficient, and more precise. While it worked in theory, it would never find the success that Taylor had so desperately hoped for; it would receive a patent from the Admiralty but would not be widely distributed or used by common mariners. Nonetheless, the mariner's compass symbolizes the efforts made by Taylor to advance the field in which she worked, and the spirit of the industrial revolution of which she became a part. In fact, this holds true for all of Taylor's instruments. One way this thesis will contribute to the historiography on Taylor is by focusing as much on her other tools as the mariner's compass. Historians such as John and Rosalind Croucher focus almost completely on the mariner's compass because while it worked in principle and logic, it was deemed by one member of the Admiralty, hydrographer Francis Beaufort, to be impractical and too delicate for the hands of the ordinary mariner. While they weren't invented by her, the hundreds of binnacles, compasses, and chronometers she adjusted encompass the ideals of the industrial revolution and, unlike her mariner's compass, were heavily utilized by sailors, captains, and mates alike.

Her influence on Victorian navigation is undeniable. Yet historians of this field and era have failed to present Taylor in such a light; she not only established both of her nautical academies of her own accord, but every one of her instruments and written pieces were produced or authored solely by her and reached a tremendous amount of seamen. Her absence from navigational and maritime histories may largely come from her physical absence aboard victorian vessels, as historians such as Jo Stanley claim. Jo Stanley's 2016 book *From Cabin 'Boys' to Captains: 250 Years of Women at Sea* explains this best: "Although some male deck officers were at least *trained* by women teachers of navigation ashore or used instruments made or repaired by Janet Taylor, women's place was seen as not at sea".⁶ Although it is only a brief mention in Stanley's book, it is a point that deserves to be expanded upon. The significance of this thesis will be the same as the significance conveyed throughout *From Cabin 'Boys' to Captains*; women deserve agency in maritime historiography and their contributions to their fields have been left largely unexplored.

Until recently, Taylor and women like her have been largely disregarded, even by scholars in women's histories. While there are authors who do attempt to use women's history as a methodological lens when writing about Janet Taylor, they often do not give her ample recognition, instead lumping her into a larger group of women who either impacted Victorian history or impacted navigational history over a longer span of time. This type of writing neglects Taylor's immediate contributions to Victorian maritime practices, ultimately under-emphasizing her historical significance. These types of works include David Cordingly's *Women Sailors and Sailors' Women: An Untold Maritime History* (2001), Mary Bruck's *Women in Early British and Irish Astronomy: Stars and Satellites* (2009), and Marilyn Bailey Ogilvie, Joy Dorothy Harvey

⁶ Stanley Jo. *From Cabin 'Boys' to Captains: 250 Years of Women at Sea*. Stroud: The History Press. 2016. 304 pp.

and Margaret Rossiter's *The Biographical Dictionary of Women in Science: Pioneering Lives from Ancient Times to the Mid-20th Century* (2000). Cordingly merely references Janet Taylor, among hundreds of other women, while authors such as Bruck, Ogilvie, Harvey, and Rossiter compare Taylor to Mary Somerville, a practicing astronomer in Ireland during the same time Taylor conducted her own work. The ways in which Taylor and Somerville are compared is examined more thoroughly in the conclusion of this thesis. Ogilvie, Harvey, and Rossiter do Taylor an additional disservice by describing giving credit for her businesses to her husband. The opening sentence to Janet Taylor's biographical entry is as follows: "Janet Taylor was married to George Taylor, founder of the Nautical and Mathematical Academy located in London's East End. Her husband also made navigational instruments there".⁷ These were both ventures facilitated by Taylor, not her husband.

The authors that have been most successful in distinguishing Taylor from her husband or the women who practised astronomy in the nineteenth century have been John and Rosalind Croucher. Through their 2016 biography on Taylor, *Mistress of Science: The Story of the Remarkable Janet Taylor, Pioneer of Sea Navigation*, and various articles about her, the Crouchers do seek to give Taylor agency by placing her life and career within the context of Victorian navigational history. While this goal is reached, and falls in line with the goals I hope to achieve through this thesis, there are many avenues for further research and historical contributions to Taylor's life and influence that are left open by *Mistress of Science* and other articles authored by the Crouchers.

In their article "Mrs. Janet Taylor and the Civil List Pension—a claim to recognition by her country", the Crouchers compare the civil list pension of Janet Taylor, £50 a year starting in

⁷ Ogilvie, Marilyn, Joy Harvey, & Margaret Rossiter. 2000. *The Biographical Dictionary of Women in Science: Pioneering Lives from Ancient Times to the Mid-20th Century*. New York: Routledge.

1860, to that of Mrs. Mary Somerville, who earns four times as much a year beginning in 1835. These authors argue in this article that this difference in pension had nothing to do with gender, since they were both women, but was determined by the socioeconomic class of each woman. Obviously, the Crouchers believe that Somerville was born into a family with a higher socioeconomic class, which was reflected in the way the Admiralty paid her after she retired; with a larger pension than those who made equal (or greater) contributions to the field but belonged, by name, to a lower socioeconomic class. This argument may be viable, but dividing these women denies them historical agency; it makes them seem like outsiders, which they may have been. But if historians compare their works, accomplishments and recognition, and eventual pensions to that of their male counterparts instead of each other, they can contextualize the influences these women on the male-dominated fields of navigation and maritime culture.

Using the ideas espoused by Stanley, women's history as a methodology can be beneficial to studies on women in maritime history, when considering they must be studied in a context not dependent on a woman's physical location. While Stanley popularized this idea, it was first established Margaret Creighton and Lisa Norling in their book *Iron men, wooden women: Gender and seafaring in the atlantic world, 1700-1920* (1996). In this book, the authors seek to provide women with agency, as they are often lacking of this in maritime history and historiography. The topics include different women throughout maritime history and their contributions to the maritime cultures of which they were a part. Creighton and Norling argue that "sailors' masculinity has varied in form and meaning, that women have played active and important roles in maritime enterprise, and that the shore has been vital in shaping seafaring experience".⁸ This argument is made because of the historiographical gap that can be filled by

⁸ Creighton, Margaret S., and Lisa Norling. 1996. *Iron men, wooden women: Gender and seafaring in the atlantic world, 1700-1920*. Baltimore: Johns Hopkins University Press. VII.

examining the influences of women on maritime culture and practice throughout history; it also addresses the important idea that these women did not necessarily have to be physically on board ships to have an effect on them. Creighton and Norling compare men and the idea of masculinity to women and their influence on maritime culture and enterprise; “the work included here demonstrates decisively that gender is a fundamental component of seafaring, as it is all of human society”.⁹ My thesis will use women’s history as a methodology to focus on Taylor and her impact on the men, and larger maritime culture, around her. Unlike Creighton and Norling’s work, it will not use men or concepts of masculinity to frame these impacts of Taylor’s, because her accomplishments were impressive enough to break through these patriarchal ideologies. Instead, it will frame her within the Victorian maritime society, and the public of private spheres, of which she was a part. For women, the industrial revolution and commercial expansion happening within the nation, while a source of exploitation for men and women, opened doors for skilled labor.

There are historians who begin to frame Taylor within these contexts, but do so using economic history, which can overgeneralize the influences of women, especially when it comes to maritime practices over time. Because most women were not experienced sea voyagers, sailors, or captains, their economic impacts on maritime fields are grouped together and under analyzed, and also often explained within more domestic contexts. This methodology allows them to use Taylor’s business ventures to frame their arguments, but still undermines the significance of her work in astronomy and mathematics. One example includes Kathryn Gleadle’s “‘The Riches and Treasures of Other Countries’: Women, Empire, and Maritime Expertise in Early Victorian London” (2013). Gleadle’s book takes three topics (women, the acceptance of empire and imperialism at a local level, and maritime identity) and examines them

⁹ Creighton, Margaret S., and Lisa Norling. *Iron men, wooden women*. VII.

through the eyes of Janet Taylor, a woman navigator, writer, teacher, and maritime expert in early Victorian London. Gleadle has used her past works to establish the idea that “dominant gender discourses of women’s public roles were affirmed and circulated despite contemporaries’ acknowledgement of the far more fluid and unpredictable patterns of female activity which operated ‘on the ground’”.¹⁰

Intersecting the fields of economic and labor history, Gleadle uses Taylor’s life and career as a case study to prove that politics and imperialism pushed the “normative” ideas about gender roles to ensure its own success. Women were working alongside men during the Victorian era, in all types of labor; the industrial pull of the age placed emphasis on skill and invention over gender and societal norms. Unfortunately, many of these women did not write about their experiences. And while Taylor did not keep a personal record or journal of her endeavours, the prefaces of her books (along with dedication letters) reveal a lot about her life and the pressures she faced while navigating a male-dominated field. Taylor transcended the traditional gender norms of her period, and Gleadle agrees that there are many other women throughout English maritime history who held similar positions of power but have yet to be given recognition of that power today, a problem the wider significance of this thesis will hope to address.

The women’s histories that come closest to the aims of this thesis are both authored by Helen Doe. In Helen Doe’s book *Enterprising Women and Shipping in the Nineteenth Century* (2009), and in her article “Travelling by Staying at Home: Women in Westcountry Ports and Their Overseas Connections in the Nineteenth Century” (2009), Doe admits to the influence

¹⁰ Gleadle, Kathryn. “‘The Riches and Treasures of Other Countries’: Women, Empire, and Maritime Expertise in Early Victorian London”. *Gender and History*. 25, no. 1. 7-26. 2013. 19.

women had on late nineteenth century trade and maritime economics, but frames this influence according to the male relationships they typically held.

Maritime women gained knowledge of places outside their local community through both direct and indirect sources. They had an incentive to know more, since the knowledge gave them a greater understanding of potential implications for their male relatives and themselves... Their motivation, apart from personal interest, was related both to their need for information about absent husbands, fathers and sons but also, for some women, in relation to their business interests".¹¹

This denies them their individuality. When Taylor is discussed in terms of her relationship with her husband, or grouped into a larger context of women in astronomy rather than navigation, the historical credit she deserves is essentially taken away from her and given to her husband (whose accomplishments were not as notable).

Because this thesis will intersect women's and Victorian navigational historiographies, one woman (Janet Taylor) will serve as an example of the ways in which female historical actors can be better represented in histories of navigation than they have previously. It will take concepts established by authors such as Ogilvie, Harvey, Rossiter, and Doe and expand on them by focusing on Taylor specifically and contextualizing her within the Victorian maritime community. For this contextualization, secondary literature such as Miles Taylor's *The Victorian Empire and Britain's Maritime World* (2013), John Winton's *Hurrah for the Life of a Sailor* (1977), and many works by N.A.M. Rodger. While none of these authors mention the impacts of women on Georgian or Victorian maritime practices, they will provide a narrative of the industry, the debates and the practices, Taylor was a part of.¹² This thesis will also rely heavily

¹¹ Doe, Helen. "Travelling by Staying at Home: Women in Westcountry Ports and Their Overseas Connections in the Nineteenth Century". 2009. *Journal Of Transport History*, 30(2), 183-199. 196.

¹² The following is a list of works on the navigational and maritime histories of Victorian England that have been essential in contextualizing the world around Janet Taylor.
Cotter, Charles H. *A history of the navigator's sextant*. Glasgow. 1983.; Croarken, M. "Tabulating the Heavens: Computing the Nautical Almanac in 18th-Century England." *IEEE Annals of the History of Computing* 25, no. 3. 2003. 48-61.; Evans, David. *Building the Steam Navy: Dockyards, Technology and the Creation of the Victorian*

on the works of John and Rosalind Croucher, namely their flagship biography on Taylor, *Mistress of Science: The Story of the Remarkable Janet Taylor, Pioneer of Sea Navigation* (2016). In intersecting women's history with the history of Victorian navigation, this thesis will use Janet Taylor as an example of how women, throughout history, can be provided with more recognition of the impacts they had on the larger fields in which they flourished.

Janet Taylor received a considerable amount of recognition, both locally and internationally, throughout her career. She received gold medals for her work from the kings of both Prussia and Holland, and the Pope. Her works were frequently reviewed, and praised, by both women's and nautical magazines and newspapers from the period. Some of her publications were even translated into other languages. Her *Luni-solar and horary tables*, for example, was translated into Dutch. If the work of Taylor was so widely recognized and utilized by the men in her field at the time, why hasn't she been represented in the same fashion by maritime historians? Why is her name not discussed along with those of John Hadley, John Harrison, and John Bird? Navigational and maritime historians should not be so uninterested in the only woman to hold a patent under the category "Compasses and Nautical Instruments" between 1617 and 1852. Taylor may not have been directly aboard the ships she held an influence over, but that influence is just as important historically as the influences held by actual navigators and sailors.

When Taylor can be examined in the same way as the sailors and captains she taught and

Battle Fleet, 1830-1906. London: Conway Maritime. 2004. 208 pp.; Forbes, E.G. *The Birth of Scientific Navigation: the Solving in the 18th Century of the Problem of Finding Longitude at Sea*. London: National Maritime Museum. 1974.; Jerchow, Friedrich. *From Sextant to Satellite Navigation. 1837-1987, 150 years*. Hamburg: C. Path. 1987. 144 pp.; Pietsch, T. (2015). The Victorian Empire and Britain's Maritime World, Edited by Miles Taylor. *Journal Of Imperial & Commonwealth History*, 43(2), 363-365.; Rodger, N.A.M. *The Command of the Ocean: A Naval History of Britain, 1649-1815, Volume 2*. New York: W.W. Norton & Company. 2004.; Rodger, N.A.M. *The Wooden World: An Anatomy of the Georgian Navy*. London: Collins. 1986.; Taylor, Miles. *The Victorian Empire and Britain's Maritime World, 1837-1901: The Sea and Global History*. Basingstoke: Palgrave Macmillan. 2013. 195 pp.; Williams, J.E.D. *From Sails to Satellites: the origin and development of navigational science*. Oxford: Oxford University Press. 1992. 320 pp.; Winton, John. *Hurrah for the Life of a Sailor: Life on the Lower-Deck of the Victorian Navy*. London: Joseph. 1977.

influenced, she (and other women like her) can begin to receive the agency in British maritime history they justly deserve. This project seeks to bring to the forefront a woman who may have not fundamentally challenged Victorian gender roles, but nonetheless transcended patriarchal norms and became a powerful influence on Victorian navigation and maritime practices. In the midst of the Industrial Revolution and an increasing demand for technological advancement and exploration, Janet Taylor used her talent and skill as an educator, astronomer, and writer to meet those demands.

Chapter 1

The Educator

Janet Taylor's childhood education, which would put her on her path to success as an educator herself, differed greatly from that of a typical Victorian middle-class girl. This experience, which was confined largely to domestic or homely practices, is best described by Deborah Gorham in her 2012 book *The Victorian Girl and the Feminine Ideal*. Gorham claims that it was "customary to refer to public and private life as two 'separate spheres'. Each of the two spheres was thought to be inextricably connected either with women or with men. The public sphere of business, politics, and professionals life was defined as a male sphere. The private sphere of love, emotions and domesticity was defined as the sphere of women".¹³ While this gendered dichotomy between the public and private spheres did hold influence over educational opportunities for Victorian middle class children, which were lacking¹⁴, the trend of rapid industrialization within the nation would also hold heavy influence on these opportunities.¹⁵ Luckily for Taylor, her father would defy the patriarchal norms expected of her society; and in disregarding the norms of the public and private spheres, Peter Ionn put his

¹³ Gorham, Deborah. 2012. *The Victorian Girl and the Feminine Ideal*. New York. Routledge Library Editions: Women's History. 238 pp. 4.

¹⁴ In 1837, when Taylor was 33 years old, "there were only four universities in England, none open to women".# This number would increase by the end of the Victorian era, with the establishment of "twelve universities and colleges which admitted women to degree courses". By this time, Taylor would be unable to take advantage of these new opportunities. And even if she had been able to, the education she would have received in lieu of what she had started under the guidance of her father and the school at which he worked would not have afforded her the success she instead achieved. This is because when the movement for women's education reform did eventually begin, it did so because women "pressed to enter medicine".# Consequently, this is the turn many forms of female education reform supported and enacted, beginning in the 1860's.

Heffer, Simon. "Founding Mothers". *New Statesman* 142 (5179). 30-33. 2013. 30.

¹⁵ This point is made by historian Simon Morgan, who acknowledges that descriptions such as Gorham's are valid, but using the context of the industrial spirit of the nation can complicate the narrative of Victorian middle class women. This thesis, like Morgan's work, will seek to contribute to the few works that "have emphasized the inconsistencies and subversive possibilities inherent in discourses of domesticity, and the way that women were able to exploit these in order to expand their role". Historian Claudia Nelson also reiterates these ideas.

Morgan, Simon. 2007. *A Victorian Woman's Place: Public Culture in the Nineteenth Century*. New York. Taurus Academic Studies. 270 pp. 2.

Nelson, Claudia. 2007. *Family Ties in Victorian England*. Greenwood Publishing Group. 196 pp.

daughter on the path to creating business opportunities as an educator in a field that contained almost no women. Taylor would use her business to influence maritime practices well into the 1860's.

Female children were largely excluded from the public education system¹⁶ and therefore restricted to either domestic practices within the home or laborious, and dangerous, occupations across various industries that required unskilled workers who could be easily replaced.¹⁷ Within the context of the industrial revolution, education was often a superfluous option, as different industries and global expansion had become a major influence on English society beginning in the eighteenth century. Stana Nenadic explains this trend in her article “Businessmen, the Urban Middle Classes, and the ‘Dominance’ of Manufacturers in Nineteenth-Century Britain” (1991), claiming that England’s “economic profile was dominated by commerce, overseas trade, and services in the eighteenth century; textile processing, the metal industry, and later shipbuilding were added in the nineteenth century”.¹⁸ Both Taylor and her father held careers reflective of this description.

For a girl growing up in nineteenth century England, one’s education and occupation was determined almost solely by her father. Victorian era fathers, if a part of the middle class, “regarded the education of their daughters as an unnecessary expense. Most... wanted their daughters in a mill or a factory as swiftly as possible to make a contribution to the household’s income”.¹⁹ This focus on industry rather than education was a defining characteristic of

¹⁶ This gender-divide in the Victorian public education system would change with the Education Act of 1870, which would allow all children to enter the public school system. This was a trend many European nations had already embraced.

Auerbach, Sascha. “‘A Right Sort of Man’: Gender, Class Identity, and Social Reform in Late-Victorian Britain.” *Journal of Policy History* 22, no. 1 (January 2010): 64–94.

¹⁷ Heffer, Simon. “Founding Mothers”. 30.

¹⁸ Nenadic, Stana. 1991. “Businessmen, the Urban Middle Classes, and the ‘Dominance’ of Manufacturers in Nineteenth-Century Britain”. *The Economic History Review*, 44(1), new series, 66-85. 67.

¹⁹ Heffer, Simon. “Founding Mothers”. 30.

England's nineteenth century working class. Historian Simon Gunn describes this context in his 2004 article "Class, identity, and the urban: the middle class in England, c. 1790-1950": "In the classical account, the middle class was forged out of the industrial revolution between 1780 and the 1830's. It was a social corollary of the dramatic changes in trade and manufacturing that characterized the economy in these decades, transforming Britain into an 'industrial nation and also bringing into being a self-conscious working class'"²⁰ This reliance on industry as a defining characteristic of the community Taylor was a part of created a context in which she would be able to flourish as an adult.

With rising needs for technological and industrial advancement, gender roles would be more likely cast aside for the betterment of the nation. Despite the number of women, including Taylor, that have proven this point, some historians nevertheless confine middle-class careers in Victorian England to one gender, describing it as "those adult males who were neither manual workers, except where these were also employers, nor aristocrats, landed gentry, or farmers".²¹ In disregarding these women who contributed to their place and time, these authors create an irony when they claim, when framing the middle class within the industrial revolution, that this part of English society was a "large and diverse business community".²²

While Taylor's early childhood education was certainly dictated by her father, his motives differed from those typical of Victorian patriarchs, which are centered largely around economics and the advancement of industry and technology. Had economic prosperity been Peter Ionn's primary concern, he would not have enrolled a young Janet (then Jane) in the school

²⁰ Gunn, Simon. 2004. "Class, identity and the urban: The middle class in England, c.1790-1950". *Urban History*, 31(1), 29-47. 31.

²¹ Nenadic, Stana. 1991. "Businessmen, the Urban Middle Classes, and the 'Dominance' of Manufacturers in Nineteenth-Century Britain". 67.

²² Nenadic, Stana. 1991. "Businessmen, the Urban Middle Classes, and the 'Dominance' of Manufacturers in Nineteenth-Century Britain". 67.

at which he taught subjects such as navigation and astronomy. This is because an education of this sort would not normally be considered a financial benefit in the long run, unless Taylor had shown exceptional potential in these areas from a young age. Perhaps he had noticed an unignorable potential for these fields in his young daughter, or perhaps it was the easiest method of supervision after the death of her mother. Either way, Taylor's father provided her with her first opportunity to transcend the educational restrictions suffered by most Victorian women. This opportunity would allow her to pursue her talents for math and science, which under normal circumstances would have been otherwise impossible.

While it is unorthodox for Ionn to have enrolled his young daughter in the all-male school at which he taught, it was not uncommon in nineteenth century England for fathers to take on aspects of motherhood and embrace family life; this is especially true for middle-class men and their families during the Victorian era.²³ Victorian patriarchs are historically represented as “breadwinners and disciplinarians”; but some historians have complicated that identity,²⁴ having “demonstrated that (mainly) middle-class men were more anxious and more caring- and even more involved in day-to-day childcare- than was compatible with a conception of the father's role as that of a properly strict provider and little else”.²⁵ It was also not uncommon for children to be cared for by their fathers, and when this could not happen in the home children would simply accompany their fathers; “there are numerous examples of fathers of the high Victorian

²³ This would begin to change at the very end of the nineteenth century as more emphasis is put on the “shared masculine experience... that is sometimes said to have constituted a ‘flight from domesticity’... when men withdrew to a more masculine culture under the influence of ‘adventure’ literature, muscular Christianity and the demands and opportunities of the Empire”.

Gordon, Eleanor & Gwyneth Nair. “Domestic Fathers and the Victorian Parental Role”. *Women's History Review* 15(4): 551-559. 2006. 555-6.

²⁴ In addition to the work of Gordon and Nair, Julie-Marie Strange and Amy G. Richter also aim to complicate the uniform narrative of middle class Victorian fathers.

Strange, Julie-Marie. 2015. *Fatherhood and the British Working Class, 1865-1914*. Cambridge: Cambridge University Press.; Richter, Amy G. "The Emergence of the Nineteenth-Century Domestic Ideal." In *At Home in Nineteenth-Century America: A Documentary History*. NYU Press. 11-51.

²⁵ Gordon, Eleanor & Gwyneth Nair. “Domestic Fathers and the Victorian Parental Role”. 554.

period revelling in family life. Fathers often took daughters with them on trips, even quite extended ones”.²⁶ Having lost the matriarch of the household after his wife’s passing, Ionn simply undertook the tasks of both providing and caring for his children, and that meant bringing Taylor into the school at which he taught.

Whether providing young Janet (then Jane) a secondary education outside of the domestic sphere out of necessity or luxury, Peter Ionn ensured that his daughter diverged from the gender roles of the Victorian period beginning at a young age. Economics could not have been the primary concern when Ionn decided to enroll his daughter in his school, because a continuing secondary education would have been unaffordable for many middle-class families such as his. The average cost of sending a daughter to a boarding school, according to Joan Perkin in her 1993 book *Victorian Women*, was “£130 a year, though some schools offered costs as low as £25 or £30 a year, according to a letter in the *Englishwoman’s Domestic Magazine* which questioned the quality of education in such places... Even the least expensive of these schools was beyond the means of most lower middle-class families”.²⁷ The salary range for middle class families during the nineteenth century varied from £200 to £1000 annually, with the average income being listed in 1901 as between £150 and £200.²⁸ The knowledge and astronomical and mathematical talents exhibited by Taylor as a young student serves as the initial step towards her eventual career-related success and impact, not only as an educator, but as an astronomer, a writer, and an inventor. These talents held by Taylor would be exhibited through her early admission into Queen Charlotte’s Royal School for Embroidering Females, a prestigious academy with a largely upper-class female student body. Had economic prosperity been her

²⁶ Gordon, Eleanor & Gwyneth Nair. “Domestic Fathers and the Victorian Parental Role”. 554.

²⁷ Perkin, Joan. *Victorian Women*. New York University Press. 1993. 32.

²⁸ Musgrove, F. 1959. “Middle-Class Education and Employment in the Nineteenth Century”. *The Economic History Review*, 12(1), new series, 99-111. 99.

father's goal, then he would not have let her pursue the scientific subjects that existed only within the public, commercial sphere of nineteenth century English society.

It was Queen Charlotte who waived the age requirement for admission and provided Taylor with a scholarship to the Royal School for Embroidering Females, which was first established by an English silk designer and embroiderer Phoebe Wright in the late eighteenth century.²⁹ Queen Charlotte highly funded and endorsed many avenues of education for females, showing a propensity for charity and education. While it was most famous for the elaborate tapestries produced by young female students there, subjects such as astronomy and mathematics were also valued and taught. Being surrounded by students of her own gender allowed Taylor to flourish without the restrictions she would have faced had she continued to attend her father's all-male school, where she would always be considered an outsider. In this instance, Gorham's idea of the public and private spheres is complicated; being able to pursue subjects that would not have aided her in the tasks of the private sphere serving as an opportunity to move fluidly between these roles.

But even with an entirely female student body surrounding her, nine year old Taylor was still separated from her peers by both her age and her interests. While most girls attending the Royal School for Embroidering Females pursued subjects such as art, music, and embroidery, Taylor was transfixed with her own "imagined globes of the earth, each with segments of 15 degrees, and saw in the landscapes and the tapestries their geometric forms and mathematical maps. She was singularly preoccupied with her own view of the universe".³⁰ Taylor became most fascinated with the navigational principles her father had taught her, such as using an orange to

²⁹ Anishanslin, Zara. *Portrait of a Woman in Silk: Hidden Histories of the British Atlantic World*. Yale University Press. 2016. 79.

³⁰ Croucher, John S. & Rosalind F. Croucher. *Mistress of Science: The Story of the Remarkable Janet Taylor, Pioneer of Sea Navigation*. Amberley Publishing. 2016. 20.

define the earth's longitudinal segments, and allowing her to experiment with lodestone³¹ in order to understand the essential workings of the compass (a crucial tool in the calculation of position and direction at sea).

Although the precise calculations would not be completed until Taylor was well into her career as an educator at her first nautical academy, the simple way in which her father had taught her (and her first classmates) to dissect the Earth according to its longitudinal segments served as a long-acting premise for what Taylor wanted to take on as a major navigational project. John and Rosalind Croucher describe this premise in their flagship biography on Taylor, *Mistress of Science: The Story of the remarkable Janet Taylor, Pioneer of Sea Navigation* (2016).

The key principle was a recognition that the earth was not a perfect sphere, but rather it was flattened at opposite ends, at the poles. It was *spheroidal*, not spherical, 'oblate spheroid' to be precise, the earth's axis at the poles being thirty-four miles shorter than that of the equator. This had to be translated in a way that would make sense to the simplest navigator. It had to be not only correct, but easy to implement, otherwise it would never be used or understood.³²

This fascination would follow Taylor upon her graduation from the Royal School for Embroidering Females at the age of sixteen. Her attendance at the Royal School for Embroidering Females would benefit her not only because it allowed her to pursue the subjects she held so much talent in, but because being an established organization among the nobility would mean that Taylor would have additional opportunities to enter the field of education.

Upon completing of her own education, she decided to become an educator herself and "readily obtained a position as governess to the family of Reverend John Thomas Huntley, Vicar

³¹ Lodestone is an early name for a mariner's compass. The properties that make up a lodestone are thought to have been discovered by the Chinese during the Middle Ages, when navigators aboard ships were commonly referred to as "lodesmen"; "Commonly it is magnetic oxide of iron (magnetite), named from a corruption of *load*, Old English *lad* (pronounced 'laid')".

Jeans, Peter D. *Seafaring Lore and Legend: A Miscellany of Maritime Myth, Superstition, Fable, and Fact*. International Marine: McGraw-Hill. 2004. 310.

³² Taylor's childhood experiments with lodestone foreshadow her career as a notable name in compass adjusting during the 1840's and 1850's.

Croucher, John S. & Rosalind F.. *Mistress of Science*.43.

of Kimbolton in Huntingdonshire”.³³ This career was not an uncommon one for young women of a similar educational and socio-economic status as Taylor at this point in her life. While working for Reverend Huntley’s family, Taylor taught subjects that most children in higher-class families were expected to learn, such as French, English, Latin, literature, and mathematics. But she also found ways in which to implement her favorite subject, astronomy, into her teachings. She uses the constellations to explain stories in Greek mythology and English literature, and uses “fruit and vegetables in aid of her astronomy and geometry lessons. In doing so she cleverly succeeded in showing the relationship of the sun, moon, and the earth, making an otherwise difficult concept seem so natural” to her students.³⁴

Teaching in Kimbolton served as Taylor’s first opportunity to exhibit her talent as an educator, by making difficult astronomical concept understandable to her students. But a role as a governess could not allow Taylor to pursue her talents to the extent running her own business could; a career as a governess was still meant to uphold the patriarchal standards and gender roles so prevalent in Victorian society. During this time, a governess “could refer to a woman who taught in a school, a woman who lived at home and travelled to her employer's house to teach... or a woman who lived in her employer's home and who taught the children and served as a companion to them”.³⁵ Either way, a governess was still leaving her home to work for another, rather than upholding the Victorian stereotype of the wife being “a woman of leisure” (and certainly a wife first); “the employment of a gentlewoman as a governess in a middle class family served to reinforce and perpetuate certain Victorian values”.³⁶

³³ Croucher, John S. & Rosalind F. *Mistress of Science*. 26.

³⁴ Croucher, John S. & Rosalind F. *Mistress of Science*. 24-5.

³⁵ Peterson, M. Jeanne. “The Victorian Governess: Status Incongruence in Family and Society”. *Victorian Studies* 14 (1). 1970. 7-26. 8-9.

³⁶ Peterson, M. Jeanne. “The Victorian Governess: Status Incongruence in Family and Society”. 8-9.

Being a governess entailed fitting into the framework of Gorham's description of the Victorian private sphere, which consists of a "cult of domesticity". This ideal "assigned to women both a separate sphere and a distinct set of rules".³⁷ Taylor certainly fulfilled these roles in some sense. After all, she would eventually marry and have children. However, Taylor's roles as an wife and educator, beyond the career of a governess, most definitely did not fit the gender stereotypes expected of a middle class Victorian woman. Even her marriage (to George Taylor Jane in 1829) was far from conventional, and that she used this domestic arrangement to break through, as much as conform with, this private sphere and the "cult of domesticity".

Taylor knew that regardless of whom she married, her career would require her to transcend the normal roles of a Victorian woman and wife and the private sphere of Victorian England. In the minds of the Crouchers, "she was determined to transcend the traditional marriage and would not contemplate doing so to a man she did not consider at least her equal in intelligence".³⁸ This mindset shows a focus on advancing her career rather than marrying for status or financial stability. These concepts are presented as part of the "limited gender roles inherent in the dominant Victorian marital ideology" in Joseph Allen Boone's article "Wedlock as Deadlock and Beyond: Closure and the Victorian Marriage Ideal" (1984).³⁹ Luckily, she met George Taylor Jane while exiting an English bookshop in the autumn of 1829. George, who had been widowed before meeting Janet, happened to be an advantageous choice of suitors for Janet for two reasons.

For one, George had entered the Navy at a young age; he serves throughout the entirety of the Napoleonic Wars and reaches the rank of lieutenant by 1815, when he finished his service

³⁷ Gorham, Deborah. *The Victorian Girl and the Feminine Ideal*. 4.

³⁸ Croucher, John S. & Rosalind F. *Mistress of Science*. 27.

³⁹ Boone, Joseph Allen. 1984.. "Wedlock as Deadlock and Beyond: Closure and the Victorian Marriage Ideal." *Mosaic: A Journal for the Interdisciplinary Study of Literature* 17, no. 1. 65-81. 66.

at the age of 23. This meant that George would have similar interests to Taylor, and the practical experience (that Janet would have never been able to attain) to help her build a navigational academy and warehouse that could be tailored to the maritime community of London. Secondly, George came from a family of Dissenters. Victorian Dissenters came in many forms. But from what little has been written about George Janet Taylor, he can be best characterized as a moderate one. For these moderate dissenters, education was an outlet for students to learn a wide variety of subjects (much like Janet Taylor had in her youth) and explore their individualistic characteristics. The “symbolic significance of free enquiry for dissenters should not be underestimated”. In addition to religious teachings, students (both male and female) were required to learn a range of subjects, including (but not limited to) “natural philosophy, classical languages and French, civil history, Jewish antiquities, and logic”. They were also encouraged to explore and read about subjects not covered by their schooling.⁴⁰ Having such a background meant that he defied typical gender and patriarchal roles. Being educated at “a school run by the Independents put girls on a par with boys and... it made him far more accepting of clever and educated women”.⁴¹ It is undeniable that George considered his wife an equal in some sense, which can be seen through his name-change on their wedding day.

George dropped his last name (Janet), which his new wife changed her first name to, in addition to taking his last name. Not only did he seek to be on equal social footing with his new wife, proving so by his willingness to change names and therefore disregard his past as a dissenter, George Taylor also sought to keep economic equality between him and his new wife. The couple forms a trust, thus keeping the money George had made and the inheritance and eventual income of Taylor’s separate from each other. For Taylor, this was imperative if she was

⁴⁰ Whitehouse, Tessa. *The Textual Culture of English Protestant Dissent 1720-1800*. Oxford University Press. 2015. 58-60.

⁴¹ Croucher, John S. & Rosalind F. *Mistress of Science*. 37.

to reach her ultimate goal; “Jane Ann had very clear ideas as to what she wanted to do with any money that was hers from her father; she wanted to open a school and to teach in his footsteps- only this would be a school of navigation. She wanted to write, publish, and do everything in her power to help young men find their way at sea”.⁴² Finding an intellectual and social equal allowed Taylor to begin her career as an educator, outside of the realm of small, private, and wealthy families. While their marriage (and eventual children) were representative of the typical Victorian family structure, the Taylors retained a unique form of individuality for the time in deciding to keep their finances separate. This economic freedom allowed Taylor to open her first nautical academy of her own accord.

The first nautical academy, which would provide classes in astronomy, mathematics, seamanship, and many other subjects relevant to sailing, was opened by Taylor in 1835 and named after her husband, the George Taylor Nautical Academy. The location of this first academy was not ideal for Taylor, who agreed with her husband that the best possible location would be on a street in London known as Minories, because it was well-known to other maritime and navigation-related businesses. But because of their socio-economic means at the time, Taylor and her husband settled for a nearby location, No. 1 Fen Court on Fenchurch street. In 1835, Taylor decided to name her first academy after George, whose reputation among the Admiralty would help promote the school.

Taylor was still the sole overseer and primary educator at the business. She would teach classes until her student body grew large enough for her to hire additional educators, all men who had taught navigation at other establishments. She would also create the texts to be used in

⁴² Croucher, John S. & Rosalind F. *Mistress of Science*. 40.

her classes.⁴³ In utilizing every one of her talents to both create and convey the knowledge necessary to locate position at sea, Taylor is using her business to navigate the patriarchal society in which she lived. The fact that she was a woman employer of men in navigation shows how she moved fluidly from the private to the public sphere.

This first academy became so influential that it was “recommended by the Admiralty,⁴⁴ Trinity House (the establishment responsible for the nation’s lighthouses) and the East India Company”.⁴⁵ All of these institutions recognized the fact that this academy was operated by a woman, but Taylor’s expertise and talents were so valuable to these institutions that, in the spirit of the industrial revolution, patriarchal boundaries and societal norms were cast aside; a blending of the public and private spheres. These organizations would endorse or allow advertisements for Taylor’s first academy in many of their publications, some of these which were also authored by Taylor for the Admiralty. *Atlas Magazine*, the *United Service Journal*, and the *Nautical Magazine* are all publications that were highly respected and endorsed by the Admiralty that

⁴³ Croucher, John S. & Rosalind F. *Mistress of Science*.

⁴⁴ The Admiralty, short for the High Court of Admiralty, was experiencing an increase in influence during the time Janet Taylor was conducting her work. While being responsible mainly for maritime crimes (crimes at sea, shipwrecks, etc.) before the mid-nineteenth century, the Victorian period’s increase in technology and maritime endeavours called for a greater role from the Admiralty. This is seen mostly in the creation of nautical maps and instruments. As steamships and iron become more commonplace in ships and vessels, more accurate and uniform maps were needed by mariners to navigate more precisely. Frances Beaufort, the hydrographer for the Admiralty during much of Janet Taylor’s career, would spend much of his time in office transitioning the Admiralty from relying solely on privately published maps and local cartographers to publishing maps developed and endorsed by those employed under the Admiralty; “Thus the publication of high quality charts accelerated during the Beaufort era. On Beaufort’s retirement, Captain John Washington, his successor, remarked that one of his great achievements was ‘the raising of the Hydrographic Office of England to a far higher level than any similar institution in Europe’”. David, Andrew. “The Emergence of the Admiralty Chart in the Nineteenth Century”. *Symposium on “Shifting Boundaries”*: *Cartography of the 19th and 20th Centuries*. ICA Commission on the History of Cartography. 2008. 13.

⁴⁵ Bruck, Mary. *Women in Early British and Irish Astronomy: Stars and Satellites*. Springer Science and Business Media. 2009. 52.

started advertising Taylor's nautical academy shortly after its opening.⁴⁶ None of these advertisements mentioned her husband.

Her gender did not go unnoticed, though. Women's magazines decided to highlight Taylor's work and its impact on navigation. In October of 1834, *The Lady's Magazine and Museum of the Belle Letters, Fine Arts, Music, Drama, etc.* evaluated Taylor's first book and its purpose in educating mariners. This publication claims that the knowledge obtained from Taylor's work "will be found extremely useful, which is perhaps the highest and, in fact, the sweetest fame".⁴⁷ The Crouchers interestingly note the influence of this review; "Such publications as *The Lady's Magazine* had wide appeal to a middle-class female audience, hungry for information and education otherwise unavailable to them".⁴⁸ The initial recognition Taylor's first nautical academy would receive may have given her the confidence to name her second academy after herself; Mrs. Janet Taylor's Nautical Academy.

Despite the recognition she gained for her first academy, Taylor knew that it would be difficult to establish herself as a professional in this male-dominated field, while living in a society that determined her roles in both the home and the outside world according to her gender. She addressed these barriers outright in her publications. The first instance is in her first book, the *Luni-solar and horary tables: with their application in nautical astronomy; containing an easy and correct method of finding the longitude, by lunar observations and chronometers; the latitude, by double altitudes and elapsed time, the azimuth, amplitude, and true time* (1833). Not only did she refer to herself as "he" instead of "her" (therefore addressing the patriarchal nature

⁴⁶ In addition to the Crouchers making this claim, newspapers from the British National Archive show a large amount of these advertisements beginning in 1834.

⁴⁷ Croucher, John S. & Rosalind F. *Mistress of Science*.

⁴⁸ Croucher, John S. & Rosalind F. *Mistress of Science*.

of her audience), she goes on to describe the difficulty in establishing herself as a woman author within the maritime field:

If then, this be applicable in the case of the strongest of the stronger sex, how much more indispensable is it that a female-- with all the disadvantages of a confined school, and the prejudices additionally which attach to any efforts that would seem to court publicity in the way of literary innovation-- should bespeak indulgence at the hands of a criticizing world, for the bold but well-meant intention, which has prompted the following attempt.⁴⁹

In mentioning the “disadvantages of a confined school”, Taylor is referring to the lack of educational opportunities afforded to her gender during the era in which she lives. While educational reform would become a prevalent trend beginning in the 1860’s, it was concerned primarily with providing women educational opportunities in the field of medicine. These new forms of education would not be available until Taylor was well on her way to becoming successful as a maritime and navigational expert, through education, publishing, and science and mathematics. Until this education reform, many women like Taylor were restricted professionally by “all the disadvantages of a confined school”. Knowing her education could only do so much for her, deciding to create her own business gave Taylor the opportunity to educate on her own terms.

In late 1835, with her maritime products and first nautical academy bringing her a steady income, Janet Taylor moved her business from Fenchurch street to No. 103 Minories, a street in the heart of maritime London. This second nautical academy was named after her and not her husband; Mrs. Janet Taylor’s Nautical Academy and Navigation Warehouse. Having initially

⁴⁹ Taylor, Janet. 1833. *Luni-solar and horary tables: with their application in nautical astronomy; containing an easy and correct method of finding the longitude, by lunar observations and chronometers; the latitude, by double altitudes and elapsed time, the azimuth, amplitude, and true time...* London: Longman, Rees, Orme, Brown, Green, and Longman. V.

established her place within the typically male-dominated fields of maritime and navigational practices, Taylor was now free to advertise her business as completely hers, without fear of losing customers, income, or respect. The *London Shipping Gazette*, for example, would publish advertisements for “Mrs. Taylor’s Nautical Academy” five times between July and September 1836.⁵⁰

Taylor’s involvement in either of her academies can be concretely proven with primary sources indicating Janet’s involvement in both the George Taylor Nautical Academy and Mrs. Janet Taylor’s Nautical Academy, in comparison to her husband. London directories from the time period show that George was only involved in the business until 1845, whereas Taylor herself was involved in this particular academy of hers until 1859, six years after her husband’s death.⁵¹ In the years following 1845, Taylor was “in fact the family’s principal breadwinner. Maritime publications such as the *Nautical Standard and Steam Navigation Gazette* would frequently advertise the courses taught by “Janet Taylor, at her Nautical Academy and Navigation Warehouse” throughout the early 1850’s. The advertisements often provided a print of Taylor’s business card and claim that at Taylor’s academy one can learn all “principles of Navigation”.⁵² The advertisements were printed often and show Taylor’s academy being

⁵⁰ “Navigation taught at Mrs. Janet Taylor’s Nautical Academy”. 14 July, 1836. *London Shipping Gazette*. London.; “Navigation taught at Mrs. Janet Taylor’s Nautical Academy”. 5 August, 1836. *London Shipping Gazette*.; “Navigation taught at Mrs. Janet Taylor’s Nautical Academy”. 12 August, 1836. *London Shipping Gazette*.; “Navigation taught at Mrs. Janet Taylor’s Nautical Academy”. 19 August, 1836. *London Shipping Gazette*.; “Navigation taught at Mrs. Janet Taylor’s Nautical Academy”. 30 September, 1836. *London Shipping Gazette*.

⁵¹ Before his death, George would leave trails of correspondence that show the endeavours he took on in lieu of working at or for his wife’s nautical academy. An 1851 letter to Sir Francis Beaufort, for example, reveals George Taylor’s goal to become a chartseller (something his wife also later accomplished). George presents himself to Beaufort as “a Candidate for the appointments, feeling assured... that I have great opportunities of promoting the sale of all Admiralty publications, particularly of the Charts”. George Taylor to Sir Francis Beaufort, 1851. John S. and Rosalind F. Croucher. *Mistress of Science*. 184.

⁵² “Janet Taylor, at her Nautical Academy and Navigation Warehouse”. 3 August, 1850. *Nautical Standard and Steam Navigation Gazette*. London.; “Janet Taylor, at her Nautical Academy and Navigation Warehouse”. 10 August, 1850. *Nautical Standard and Steam Navigation Gazette*.; “Janet Taylor, at her Navigation Warehouse”. 11 January, 1851. *Nautical Standard and Steam Navigation Gazette*.; “Janet Taylor, at her Navigation Warehouse”. 8

advertised alongside other nautical academies in London, all run by men. This is a remarkably energetic record for a woman who also brought up six surviving children.⁵³

While Taylor was the primary educator at her first nautical academy, it is uncertain how involved she was in teaching actual classes at her second nautical academy. Teaching a smaller number of classes after expanding her business would be unsurprising given the amount of publishing and instrument-making she was involved in during these later years. Authors such as Mary Bruck speculate why this is, wondering “whether it was considered inappropriate for a woman to teach male classes in person”.⁵⁴ The number of classes taught by Taylor at her second academy is irrelevant when one considers the fact that she held the financial responsibility and was the decision maker for the business.

This is made evident in her employment decisions, which reveals to us the growth and credibility experienced by Taylor and her business. She was studious in these decisions, retaining James Griffin in 1835. Griffin had been extremely well-known for working as an examiner for Trinity House and authoring a plethora of books on nautical navigation and the calculations required to travel by sea. Being a notable author, Taylor would be drawn to the attention and credibility his employment at her business could offer. Not only does she praise his talents in her second edition of the *Lunar Tables* (1835), in September of 1836 she specifically addresses a letter to Sir Francis Beaufort, the hydrographer for the Admiralty, that expresses her joy in his employment under her:

March, 1851. *Nautical Standard and Steam Navigation Gazette*.; “Janet Taylor, at her Navigation Warehouse”. 22
 March, 1851. *Nautical Standard and Steam Navigation Gazette*.

⁵³ Taylor would have six children throughout her career, the first being born shortly before the opening of her first academy. While Taylor did employ one woman as a maid and nanny, her residence being located directly above her business allowed Taylor to mesh her public and private spheres, simultaneously fulfilling the role of wife, mother, and businesswoman.

Bruck, Mary. *Women in Early British and Irish Astronomy: Stars and Satellites*. 52.

⁵⁴ Bruck, Mary. *Women in Early British and Irish Astronomy: Stars and Satellites*. 52.

The gentleman teaching for me is a good Geometer and Mathematician and possesses a knowledge of Navigation seldom to be met with, and so confident am I of his superior abilities on these points that I would not hesitate placing him on trial with the best and most clever man in the Kingdom as his competitor... So highly are we spoken of and appreciated by all who know us that we, at this moment, have a gentleman studying with us who is himself preparing young men for Addiscombe, and who came to use from the recommendation of a man who was formerly *prejudiced* against us in the highest degree.⁵⁵

It is obvious that Taylor valued the work that Griffin did at her second nautical academy. This quote is also representative of the impact her academy had and the reputation it built for itself within a short amount of time, made obvious by the comment she makes about the student who is actually an educator in the nautical and navigational field himself, preparing future maritime officers at Addiscombe. Addiscombe was a military seminary created by the East India Company in 1809. Because of the Napoleonic Wars, other notable military seminaries in England were unable to produce the number of officers that the East India Company needed for its army at the beginning of the nineteenth century. After two years of education, “cadets who passed their final examinations were commissioned into the company’s engineers, artillery, and infantry on the basis of merit”.⁵⁶

He chose to attend her nautical academy over others, against the prejudicial opinions of his colleagues. While the exact type of prejudice is not addressed in her letter, it is doubtful that her gender and socioeconomic status did not play a role in its creation. It is also interesting to note here that Taylor is again transcending patriarchal boundaries based on gender. Not only is she a female, pregnant and wed, employing a male to run part of her business; she is also a woman who is a leader of men who are working in an almost completely male-dominated field.

⁵⁵ Croucher, John S. & Rosalind F. *Mistress of Science*. 100.

⁵⁶ Raugh, Harold E. *The Victorians at War, 1815-1914: An Encyclopedia of British Military History*. Oxford: ABC-CLIO. 2004. 5.

The establishment of Janet Taylor's second nautical academy had a much larger impact on young Victorian mariners because an expansion in space allowed her to house pupils who may have not been able to learn under her leadership otherwise. The expansion of her second nautical academy was highly endorsed by (and received funding from) some of the most prestigious navigational and nautical organizations. These include the Admiralty, the Trinity House, and the East India Company (the Kings of both Prussia and Holland also recognized this academy of Taylor's). The Admiralty, Trinity House, and East India Company were also supportive of Taylor's first academy. Attendance to this nautical academy was highly valued, especially since changes in navigation laws had pushed for mariners to have more training and knowledge in navigational and maritime practices. Taylor described these new laws in an 1835 letter to the Admiralty, which ultimately thanked them for their financial support of this second nautical academy; "The recent alterations in the Navigation laws rendering it necessary that the sciences of Navigation should be taught, with more attention its fundamental principles, and every care that the junior pupils should be progressively fitted for the highest grade of examination, as they become qualified by age, &c."⁵⁷

Taylor's Nautical Academy offered training in every subject a mariner could possibly need: "a complete course on Navigation, including Trigonometry, and its application to Navigation. Another course was Algebra, Geometry, Physical Geography in relation to the velocity of tides, waves, etc. Mechanics including the Composition of Forces, Mechanical powers, the Laws of Motion, the strength of strain, of materials; wind, rain, steam powers, Atmospheric and Oceanic Phenomena... and so it continued..."⁵⁸ Taylor wanted to tackle the education of Victorian mariners from all sides, having been unsatisfied with the standards that

⁵⁷ Rose, Laura. *Poppy's with Honour*. AuthorHouse. 2014. 87.

⁵⁸ Rose, Laura. *Poppy's with Honour*. 87.

had previously been set for this field. These subpar standards stem from a major inconsistency in maritime education of the period, where more traditional mariners felt inclined to stick to, and teach, tried-and-true methods of navigation rather than acclimate to new mathematical and astronomical calculations such as Taylor's.

In numerous letters to Admiralty members, and other works, Taylor was “most critical of the ‘shameful manner’ in which navigation had been, and continued to be, taught... At least through an academy of her own the wrongs she alleged in the instruction of others could be rectified”.⁵⁹ Taylor was certainly successful in her endeavour to improve navigational and maritime education for young seamen. Her academies were endorsed and advertised by various royalty and navigational organizations and publications throughout the late 1830's and 1840's. The *Shipping and Mercantile Gazette* was one of the first to frequently advertise Taylor's nautical academy, beginning in September of 1838 (the academy would be mentioned in three issues that year, boasting the “improved method of tuition” she practiced). This nautical magazine would also promote her school throughout the 1840's, long after her husband started his own, separate endeavours.⁶⁰ Educational resources produced by Taylor were also heavily utilized by sailors, whether they had been her pupils or not. Her books and manuals would be sold and made available to mariners beyond the walls of her academy, allowing them to educate themselves according to her written instruction.

Not only did Taylor's published works improve formal education for mariners, she created navigational tools that made calculating one's position at sea more precise and accounted

⁵⁹ Croucher, John S. & Rosalind F. *Mistress of Science*. 100-1.

⁶⁰ “Navigation Warehouse and Nautical Academy, Mn. Taylor, 104 Minories”. 28 September, 1838. *Shipping and Mercantile Gazette*. London.; “Navigation Warehouse and Nautical Academy, Mrs. Taylor, 104 Minories”. 4 October, 1838. *Shipping and Mercantile Gazette*.; “London, Monday, October 29, 1838”. 29 October, 1838. *Shipping and Mercantile Gazette*.; “Navigation Warehouse and Nautical Academy, Mrs. Taylor, 104 Minories”. 29 December, 1838. *Shipping and Mercantile Gazette*.; “Navigation”. 24 December 1845. *Shipping and Mercantile Gazette*.; “Navigation”. 7 January 1846. *Shipping and Mercantile Gazette*.

for the growing amount of iron on newer steamships.⁶¹ Part of Taylor’s influence as an educator came from the products she manufactured in the same location as her nautical academy. An 1850 trade card she had published, for example, advertises her nautical academy alongside her title as a “mathematical instrument manufacturer” and her reputation as being the location in which “nautical instruments made and repaired on the premises”.⁶² Her roles as instructor and instrument maker are fluid, often working together to achieve the same goal; to properly educate current and future mariners.



Figure 1. Janet Taylor’s 1850 trade card, 4” x 3”, published in London. This was sold to a private buyer by Ashman Antique Nautical Paper.

⁶¹ The technological advancement of navigational tools was of utmost importance in Victorian England; iron ships were becoming more popular and England had been long-established as a world power by way of its navy and shipping industry. Taylor’s career existed during the midst of this industrial revolution, when “significant quantities of iron came to be used in ships’ hulls in the first decades of the nineteenth century, and the 1830s and 1840s saw unprecedented transformations in ship technology with the development of the iron steamer. The irregularities in compasses caused by this iron (and the consequent disasters at sea) made the issue of safe navigation a focus for debates”.

Winter, Alison. “Compasses all Awry: The Iron Ship and the Ambiguities of Cultural Authority in Victorian Britain”. *Victorian Studies* 38(1): 69-99. 1994. 70.

⁶² Taylor, Janet. 1850 Trade Card.

Before the industrial revolution and the introduction of iron steamships, little formal education existed for new and older mariners alike. Much of a mariner's expertise during this period came solely (or at least largely) from experience; learning from working. Even today seafarers move up or advance in their careers by gaining hands-on experience rather than attaining a formal education in maritime practices. As technology on ships advanced and exploration and voyages lengthened, the need for more formal modes of education arose; "for the most part this advanced vocational education, in nautical astronomy and associated topics, had to be obtained from 'mathematical practitioners' ashore who offered their services in increasing numbers from the sixteenth century".⁶³ These "mathematical practitioners" charged fees for attendance at their schools, and were funded both privately and by state institutions. With the implementation of these newer forms of formal maritime education and training came a "close relationship between nautical instrument making, the publishing of nautical books and charts and the teaching of navigation in 'one-stop' establishments known as navigation warehouses".⁶⁴ As can be seen through the heavy advertising of her academy and documents such as her trade card, Taylor took on all parts of this relationships, and did so successfully.

⁶³ Kennerley, Alston. "Writing the History of Merchant Seafarer Education, Training and Welfare: Retrospect and Prospect". *The Northern Mariner* XII (2): 1-21. 2002. 4.

⁶⁴ Kennerley, Alston. "Writing the History of Merchant Seafarer Education, Training and Welfare: Retrospect and Prospect". 6.

Chapter 2

The Author (and Publisher)

Janet Taylor, through developing a career as an author and publisher, reached an audience much larger than those who simply set foot in her nautical academies. By gaining support from the Admiralty, Trinity House, and the East India Company, Taylor was able to disseminate her writings to those who couldn't attend her classes. These mariners trusted her mathematical principles because of the support given by these organizations. In short, Taylor created a successful career for herself by using her talent as a writer to convey complex principles and calculations to this common mariner, thus providing them with the opportunity to advance through the ranks without having to rely on physical experience aboard vessels alone. Taylor's career as an author begins during the same period as the establishment of her nautical academies, as many of her books would be used as texts for her classes.

In 1833 Taylor published a book whose purpose was meant to simplify the calculations of astronomical navigation for mariners, specifically by using these calculations to locate one's position at sea using the moon (rather than the sun) as one's point of reference. This book, titled *Luni-solar and horary tables: with their application in nautical astronomy; containing an easy and correct method of finding the longitude, by lunar observations and chronometers; the latitude, by double altitudes and elapsed time, the azimuth, amplitude, and true time*, is published in the midst of a critique on the evolving methods of navigation. Most of this critique revolved around finding methods of perfectly calculating longitude while at sea. Alison Winter explains the context of this conflict in her 1994 article "Compasses All Awry: The Iron Ship and the Ambiguities of Cultural Authority in Victorian Britain". With the development of iron ships throughout the 1830's and 1840's came compass irregularities (because of the increase in metal

aboard these vessels) that “made the issue of safe navigation a focus for debates about public expertise and authority”.⁶⁵ Taylor would contribute majorly to the accomplishment of this feat by proving that the earth is spheroidal, not spherical, and conveying this through her first book. During the middle of the century, Taylor would be among the “captains, scientists, engineers, underwriters, passengers, merchants, and members of the Admiralty engaged in these debates”.⁶⁶ This climate would help Taylor succeed as an author, the need for mathematical advancement creating opportunities for anyone who could improve the field of navigation.

Taylor tacked this nautical debate in the preface of her *Luni-solar and horary tables*; “When a new writer obtrudes himself upon the Public in the capacity of Reformer of long-established usages... something like an apology may be deemed requisite on his part to qualify an undertaking, which may otherwise seem presumptuous”.⁶⁷ Taylor recognized the contribution she was about to make her field, providing mariners with calculations that are more precise and efficient than long-used practices. It is particularly interesting to explore Taylor’s use of “himself” and “his” in place of “herself” and “her” in the previous statement. Even though this publication was authored solely by Taylor, she uses this language as an explicit acknowledgment of the patriarchal nature of the field of navigation and on a larger scale the Victorian society of which she was a part. She even has to make a case for the credibility of her publication, being written by a woman in this time of nautical and navigational critique. This is not the only instance in this publication’s first pages that implicitly addressed Taylor’s life, career, and

⁶⁵ Winter, Alison. “Compasses all Awry: The Iron Ship and the Ambiguities of Cultural Authority in Victorian Britain”. *Victorian Studies* 38(1): 69-99. 1994. 70.

⁶⁶ Winter, Alison. “Compasses all Awry”. 70.

⁶⁷ Taylor, Janet. 1833. *Luni-solar and horary tables: with their application in nautical astronomy; containing an easy and correct method of finding the longitude, by lunar observations and chronometers; the latitude, by double altitudes and elapsed time, the azimuth, amplitude, and true time...* London: Longman, Rees, Orme, Brown, Green, and Longman. V.

gender roles. This becomes obvious from the very beginning of the book, where Janet dedicates her first work to King William IV, son of Queen Charlotte, in a brief letter.

Before dedicating her first book to King William IV, Taylor sought his permission to do so, and with good reason. Not only would it allow her to gain some credibility and respect among both the nobility and the maritime community but it would allow her to pay her respects to the mother of King William, Queen Charlotte. It makes sense that Taylor would want to recognize this former English monarch because it was her goodwill and interest in female education that both developed the Royal School for Embroidering Females and provided a young Taylor with a scholarship to attend that academy when most young girls from her socioeconomic standing would not have been afforded similar opportunities.

At first, when the king read Taylor's *Luni-solar and horary tables* he was so impressed with her mathematical principles and ability to write in a way that would be readable to the common mariner that he offered her a job among the nobility as an educator. In the words of John and Rosalind Croucher, "Indeed, so taken was he with Janet's enterprise and obvious intelligence, he suggested to her that she might lend her services as a reader to his fourteen-year-old niece, and likely heir to the throne, the Princess Alexandrina Victoria".⁶⁸ Although this career path would have made a good fit given her childhood education (and would have left her well-off economically) Taylor politely declined this offer, being pregnant with her first child and completely engrossed in her own ventures, her first nautical academy, and her first book publication. Thankfully for her, King William still agrees to have her dedicate her book to him. Having such a notable recipient would be beneficial to Taylor's career as a writer, regardless of gender, especially at the very beginning of it.

⁶⁸ Croucher, John S. & Rosalind F. *Mistress of Science*. 60.

The opportunity to teach among the British royalty would have been relished by the typical middle-class Victorian woman, serving as an alternative to “serving in a shop or working in a factory alongside working-class girls”.⁶⁹ This job offer would also have only been given to a woman, the title of governess being considered domestic rather than professional.⁷⁰ In offering this job to Taylor after reading her *Luni-solar and horary tables*, King William IV is enforcing the female stereotypes existing within Victorian England, lumping her skills and expertise in with the group of “middle-class women whose birth and education defined them as ladies”.⁷¹ Despite Taylor’s extraordinary talents and intelligence in maritime topics, the king’s first instinct is to provide her with a job that benefits his own family and restricts Taylor and her work to the patriarchal system, and the public and private spheres, within which Victorian women lived. At the same time, however, King William allowed Taylor to transcend the gender-based stereotypes of the period, which can be seen in his acceptance of her dedication letter despite her decline of the governess title to Princess Alexandrina Victoria. In doing this, the king openly endorsed the work and talent of a woman seeking to ameliorate navigational practices, an overwhelmingly male-centric field. King William IV, through both his offer to Taylor to teach his own family and through his support of her first book, served as an example to the British public of how gender stereotypes could be both enforced and transcended; or in Taylor’s case, navigated and used to one’s professional advantage.

Taylor was open about her anxieties towards the criticisms she would inevitably receive following the publication of her first book. She was also open about the fact that his support and her dedication of the book to King William IV would calm some of these future criticisms. This

⁶⁹ Hughes, Kathryn. 2014. “The figure of the governess”. The British Library. <https://www.bl.uk/romantics-and-victorians/articles/the-figure-of-the-governess>

⁷⁰ An analysis of the governess role and why it was considered a woman’s work over a man’s is presented in the previous chapter.

⁷¹ Hughes, Kathryn. 2001. *The Victorian Governess*. London: Cambridge University Press. 278 pp. XVI.

is all conveyed in the first sentence of Taylor's dedication letter to the king, writing "With much anxiety I launch this Volume into a criticising world, and would claim for it your Majesty's support and protection, hoping that the practical knowledge you possess of a science it may tend to benefit".⁷² She also subtly acknowledged his interests in her fields of expertise, hoping that he (like the rest of her readers) would benefit from her work in the fields of mathematics, astronomy, and maritime navigation. Having a member of the nobility show support for a work that would allow Taylor to initially establish herself as an author would only be half the battle, for reviews and positive public reception would be crucial if she hoped to gain credibility for herself.

The first review of Taylor's *Luni-solar and horary tables* was published in 1833 by the *United Service Journal and Naval and Military Magazine*. Authored by Henry Colburn and published four times a year, many contributors during the 1830's would be Admiralty members or notable captains and masters aboard wooden and iron ships. The magazine's topics were many, including narratives of experiences, debates centered around the scientific and mathematical advancements in maritime technology or practice, and reviews of the newest and most widely respected books on navigation. This first review was more than she could have hoped for. It praised her work and abilities as a mathematician, encouraged mariners to buy her book, and openly addressed her gender. From the very beginning, these three things are reiterated throughout the review.

We have examined it sufficiently to recommend it a berth in the mathematical library of every navigator. Indeed, when it is announced that a lady, soaring above petty pursuits and frivolity, has drilled her mind to the difficult and responsible labour of clearing away all obstacles from the *paths* of the ocean, we are sure that the attempt will be received with as much gratification as surprise, and that the

⁷² Taylor, Janet. 1833. *Luni-solar and horary tables*. III.

name of Miss Janet Taylor will be respectfully mentioned in many a floating castle.⁷³

This portion of the review is the only one presented in the Crouchers' flagship biography on Taylor, *Mistress of Science: The Story of the Remarkable Janet Taylor, Pioneer of Sea Navigation*. While this early portion of the review is important in proving that Taylor was respected and promoted throughout the maritime community from the beginning of her career as an author, the remainder of the document is equally compelling. Colburn acknowledged the ways in which Taylor's mathematical principles made navigation by sea more precise, beginning by critiquing the mathematics developed by mariners before her. In his discussion of the older, tried-and-true principles used to find longitude at sea, Colburn claimed that "the conditions upon which the formulae were erected did not embrace all the minutiae of which they were capable, for they mostly regarded the earth as a mere globe: and it is this difference between the perfect and oblate spheres which has called forth the exertions of Miss Taylor".⁷⁴ This is recognition, in a reputable journal, of a major mathematical breakthrough in Victorian navigational practices. The mathematical principles used up until this point were not precise or exact, which had to constantly be taken into account when locating one's position at sea.

The reason for this margin of error was that in these calculations, the shape of the earth was regarded as a perfect sphere. By taking into account the actual, spheroidal, shape of the earth, Taylor was able to get rid of this margin of error. While the review did exhibit surprise at the fact that this was done by a woman, it still gave her due credit, hoping that "sailors will show their approbation of the authoress by procuring her book".⁷⁵ These remarks show that, in the spirit of the industrial revolution, the advancement of industry and society was favored over a

⁷³ Colburn, Henry. *United Service Journal and Naval and Military Magazine, 1833 Part III*. Richard Bently: London, 1833. 212.

⁷⁴ Colburn. *United Service Journal and Naval and Military Magazine, 1833 Part III*. 213.

⁷⁵ Colburn. *United Service Journal and Naval and Military Magazine, 1833 Part III*. 212.

gender discourse. Such a successful review in the *United Service Journal* meant that Taylor had accomplished her initial goal of getting an authority in the field on her side, considering the importance of these major nautical publications and that many of these publications' authors worked for different branches of the Admiralty.⁷⁶

The *United Service Journal* was not the only publication to quickly provide the public with reviews of Taylor's first book. By the end of 1833, reviews for the *Luni-solar and horary tables* were printed in both *The Atlas* and the *Morning Advertiser*. Two reviews from *The Atlas* described Taylor's book as providing a "new, improved, and concise method of obtaining the Longitude by Lunar Observation" and "recommend it to the perusal of the inquisitive in matters of this description".⁷⁷ It is significant that her contribution to the field was so positively, and publicly, received. This is because calculations in finding longitude using the moon were in their infancy; with the rise in safe travel with iron and steamships came an increase in nighttime navigation. The *Morning Advertiser*, which did not focus on maritime topics exclusively and would therefore reach an even broader audience, contains a review published only a few months after the book came out. Despite this short time period, the authors were still apologetic, claiming "we are apparently to blame for not having hitherto noticed this very extraordinary production".⁷⁸

In 1834 when Taylor published a shorter version of her first book, titled *The Principles of Navigation Simplified: with Luni-solar and horary tables, and their application in Nautical*

⁷⁶ While Henry Colburn was never a mariner himself, all contributors he worked with in creating each addition of the magazine were. For the third edition published in 1833, the same edition that contained the first review of Taylor's *Luni-solar and horary tables*, some of these mariners include: Major George Gawler of the Royal Navy, Captain W.H. Smyth, and newer members of London's maritime community like T.H.B., who does not provide a full name but describes himself as part of the "uninitiated *fresh-men*, whose minds are bent on salt-water excursions".

Colburn. *United Service Journal and Naval and Military Magazine, 1833 Part III*. 207.

⁷⁷ "Navigation. Just Published." 1 September, 1833. *The Atlas*. London.; Untitled review of *Luni-solar and horary tables*. 29 December 1833. *The Atlas*.

⁷⁸ Untitled review. 11 October 1833. *Morning Advertiser*. London.

Astronomy, The Atlas posted reviews similar to those for her *Luni-solar and horary tables*. *The Atlas* characterized *The Principles of Navigation* as being a new addition to her already widely “celebrated works”.⁷⁹ These raving and consistent reviews would give Taylor’s career as an author the necessary credibility to seek support for future publications from the most influential maritime organizations: the Admiralty, Trinity House, and the East India Company.

After initially gaining the approval of such significant organizations with the publication of her first book in 1833, Taylor again sought the support of the Admiralty, Trinity House, and East India Company in 1835. She had hopes of publishing another edition of her *Luni-solar and horary tables*, “with an abridged or simplified method for clearing lunar distances”.⁸⁰ Not only would Taylor receive the support she needed, in the form of a £100 science grant, this support was publicized by both the Admiralty and maritime magazines from the period. John and Rosalind Croucher provide concrete proof of this in their 2012 article “Mrs. Janet Taylor and the Civil List Pension- a claim to recognition by her country”. The Crouchers quote the Admiralty Minute Book for the 19th of June, 1835, where Dr. Thomas Romney Robinson explains why Janet Taylor is receiving this science grant: “Mrs. Taylor’s formula has been investigated by very competent authority and it does certainly much abridge the solution of Lunar Distances. A small donation to assist her in printing her tables would therefore, I think, be well bestowed”.⁸¹

What previous authors do not notice about this record is how it shows the geographic span of Taylor’s influence. Not only was Dr. Robinson a member of the Admiralty, he was primarily the director of the Armagh Observatory, located in Ireland. Her publications, and the

⁷⁹ “The Principles of Navigation Simplified: with Luni-solar and horary tables, and their application in Nautical Astronomy”. 24 August, 1834. *The Atlas*.

⁸⁰ Croucher, John & Rosalind. “Mrs. Janet Taylor and the Civil List Pension- a claim to recognition by her country”. *Women’s History Review* Vol. 21, No. 2. 2012. 253-280. 258.

⁸¹ Croucher, John & Rosalind. “Mrs. Janet Taylor and the Civil List Pension- a claim to recognition by her country”. 259.

reputation she received for them, spread far beyond the hub of maritime London. Even in March of 1863, her work would be praised by the scottish newspaper *Herts Guardian, Agricultural Journal, and General Advertiser*; the authors would claim that “no matter how much one tries, one can’t do so well as the aforesaid Janet”.⁸²

With her reputation as a credible author firmly established by the mid 1830’s, Taylor was ready to tackle her next major book: *An Epitome of Navigation and Nautical Astronomy, with the improved Lunar Tables* (1842). This book, like her *Luni-solar and horary tables*, was positively received by the maritime community of London. The 1842 volume of *The Nautical Magazine: A Journal of Papers on Subjects Connected with Maritime Affairs* was one of the first to review *An Epitome of Navigation*, shortly after it was published. The following is the short but straightforward review:

The present season is prolific in works of this kind, and has in consequence imposed on us a task which must not be hastily performed. We shall, therefore congratulate Mrs. Taylor on having concluded the labours of her new edition, and reserve our observations on her performance for another number, when we shall look further into these recent productions for enlightening the minds of our seamen.⁸³

This brief review is revealing of several factors faced by Taylor as both a female and an author on Victorian navigational principles. Regardless of gender, Taylor has to compete with the plethora of works being written about navigation. As short as the review is, it is still notable that her work would be found “prolific” enough to be publicly congratulated despite the restrictions posed by the magazine in the review. Further, it is ensured that her work will be later reviewed

⁸² “Janet Taylor, Elginshire”. *Herts Guardian, Agricultural Journal, and General Advertiser*. 7 March 1863.

⁸³ “New Books: An Epitome of Navigation and Nautical Astronomy, with the improved Lunar Tables.- By Janet Taylor, 103, *Minorities*, 1842.” *The Nautical Magazine: A Journal of Papers on Subjects Connected with Maritime Affairs* vol. 11. 877.

more thoroughly for the purpose of “enlightening the minds of our seamen”. Phrases like this reveal the investment maritime organizations and publications were willing to put into Taylor and her work. Other reviews will reflect the praise for *An Epitome of Navigation* that was initially shown by *The Nautical Magazine*. In their “Literature” section, a December 1842 issue of *The Era*, for example, will describe Taylor as “a celebrity which has carried her name to many parts of the globe”.⁸⁴

To continue promoting herself as an author, Taylor employed some of the same tactics she had in her first book, including an appeal to the aristocratic figures who could help her advance her career. Like her *Luni-solar and horary tables* (1833), Taylor began *An Epitome of Navigation, and Nautical Astronomy, with the Improved Lunar Tables* (1842) with a brief dedication. Instead of addressing this to the reigning monarch, Queen Victoria, Taylor instead decided to dedicate her book “To The Honorable, The Elder Brethren of the Corporation of Trinity House, London”. From its official beginnings, Trinity House has played a major role in British maritime and navigational history, as historian Walter Mayo writes; “As the Body Corporate of the seamen of England the Corporation has played a conspicuous part in building up the greatness, and in upholding the honour of the nation, and it was in its earlier days both the cradle of the navy and the nurse of the mercantile marine”.⁸⁵

By the time Taylor established herself as an author, Trinity House had gained popularity and credibility primarily for its protection of the Thames and its aid to the Royal Navy during the

⁸⁴ “Literature”. 25 December, 1842. *The Era*. London.

⁸⁵ While much of the early history of the Trinity House has been lost, many consider the reign of King Henry VIII as the official beginning of the organization. According to Walter Mayo in his 1905 history of Trinity House, “Froude says that when Henry VII. came to the throne he found England without a fleet, and without conscious sense of the need of one”. Between trading amongst ports, currently ongoing wars (including rising tensions with the Spanish and their Armada), and problems with piracy, King Henry VII found it necessary to create an organization that would cohesively and effectively use maritime power to protect and provide for England: the Master, Wardens, and Assistants of the Guild, Fraternity or Brotherhood of the Most Glorious and Undivided Trinity and of St. Clement in the Parish of Deptford in the County of Kent. Mayo, Walter H. *The Trinity House, London, Past And Present*. London: Smith, Elder & co., 1905. 10.

invasions of the Napoleonic Wars.⁸⁶ Taylor acknowledged the authority held by Trinity House when reassuring them that their support will draw the interests of British seamen; “I feel assured, the prominent position you occupy in this Maritime Kingdom, as the active Promoters and Encouragers of whatever tends to advance the real interests of Navigation, will secure for it the attention and support of the British Mariner”.⁸⁷ She also thanked Trinity House for their “gracious permission, to dedicate to your Honorable Body my ‘Epitome of Navigation and Nautical Astronomy’”.⁸⁸

Overall, Trinity House was also a major influence on other maritime organizations existing in Victorian England. For Taylor, it was imperative that she find a way to gain their continued respect and support, which she most certainly did. After receiving support from the Admiralty for her *Luni-solar and horary tables* and her *Epitome of Navigation*, both Trinity House and the East India Company lent their support. As the Crouchers describe it: “The Admiralty grant had now provided her considerable leverage with the Elder Brethren of Trinity House... The East India company then followed shortly afterwards and the third edition of *Lunar Tables* was dedicated to each of them”.⁸⁹ The support she received from Trinity House, exhibited through her dedication of the book to them, is also heavily publicized in reviews and advertisements for newspapers. These advertisements distinguish Taylor’s work from others in noting that her *Epitome of Navigation* “is dedicated, by permission, to the Honorable Elder

⁸⁶ As fears about these invasions rose, English citizens and government officials alike began to worry about the power of the Royal Navy. As such fears reached their peak, the Elder Brethren of Trinity House “came again to the assistance of the country by offering to equip, officer, and man ten frigates then lying up, and moor them across the Thames in the Hope for the protection of the Metropolis”. The Trinity House and its members proved to be an incredibly useful resource during the Napoleonic wars, and this one effort alone had a wide ranging impact that the English government and Royal Navy were both grateful for.

Mayo, Walter H. *The Trinity House, London, Past And Present*. 33.

⁸⁷ Taylor, Janet. 1842. *An Epitome of Navigation, and Nautical Astronomy, with the Improved Lunar Tables*. London: Poplett. III.

⁸⁸ Taylor, Janet. *An Epitome of Navigation*. III.

⁸⁹ Croucher, John S. & Rosalind F. “Mrs. Janet Taylor and the Civil List Pension- a claim to recognition by her country”. 259.

Brethren of the Corporation of the Trinity House”.⁹⁰ This further established her credibility in the field of navigation, and gained her respect as an author.

While the dedication letter in *An Epitome of Navigation* may seem almost submissive in tone, the preface of the book is more assertive in its disregard of the fact that the Victorian maritime community is predominately male. This is especially true when compared to the preface of Taylor’s maiden publication, the *Luni-solar and horary tables*. The preface to Taylor’s *An Epitome of Navigation* is not as explicitly male-centric in comparison to the *Luni-solar and horary tables*, but she does still make obvious how one-sided (according to gender) the audience of her new work is. In the first few paragraphs of her preface, for example, the audience is termed as simply the “Practical Navigator” and then “the student”.⁹¹

It is not until the third paragraph of her preface in *An Epitome of Navigation* that Janet gendered her audiences, the students and the “Practical Navigator” she referred to in previous paragraphs; the vast variety of maritime and nautical issues and practices “is pointed out so clearly, as to enable the student, by making him acquainted with the principles upon which they are founded, fully to understand, and easily to retain the rules for performing those operations which follow in the work”.⁹² Considering the credibility Taylor gained for her work in the nine years between the publications of her *Luni-solar and horary tables* and *An Epitome of Navigation*, it can be assumed that she was no longer solely concerned about proving herself as a

⁹⁰ “Advertisements and Notices”. 23 October, 1842. *The Era*.; “Navigation- Just Published”. 28 October, 1842. *Shipping and Mercantile Gazette*.; “Navigation- Just Published”. 11 November, 1842. *Shipping and Mercantile Gazette*.; “Navigation- Just Published”. 18 November, 1842. *Shipping and Mercantile Gazette*.; “Advertisements and Notices”. 4 December, 1842. *The Era*.; “Navigation- Just Published, Anew”. 10 December, 1842. *Newcastle Journal*. Northumberland.; “Navigation- Just Published”. 6 January, 1843. *Shipping and Mercantile Gazette*.

⁹¹ This example comes from the first paragraph of the preface in *An Epitome of Navigation*: “It may however be as well to observe, that in the present Volume, the greatest care has been taken that while nothing really important to the Practical Navigator is omitted, all needless varieties of methods, and other extraneous matter are studiously avoided, and in the arrangement, great pains have been taken to present each part in that natural order, which may render it most accessible to the student”.

Taylor, Janet. *An Epitome of Navigation*. V.

⁹² Taylor, Janet. *An Epitome of Navigation*. V.

woman in the field of maritime practices and navigation. In fact, by the late 1840's, Taylor would stop writing dedication letters altogether.⁹³ Her reluctance to constantly refer to her readers and students as males in this second book may also have been affected by the fact that there was a small, but growing, number of women creating reputations for themselves in the fields of astronomy and mathematics (such as Mary Somerville), but not necessarily in maritime navigation. Taylor was also notable in comparison to her few female counterparts in that she created two careers out of her writing abilities, that of author and publisher.

Publishing the works of others was beneficial to Taylor for two reasons; not only did it establish her as a prominent figure in maritime literature, it allowed her to further advertise her other services. A perfect example of one such work is the 1865 edition of Karel Pieter Ter Reehorst's *Mariner's Friend and Technical Dictionary in Ten Languages*. The first two pages of this book are advertisements for Taylor's services, specifically her "Nautical and Mathematical Academy" and her business as a "Chart and Nautical Bookseller and Publisher, Agent for the Sale of Admiralty Charts".⁹⁴ These two advertisements fill two full pages and reveal a great deal about the businesses run by Taylor, who at this point was now a widower.

The advertisement for her academy is very thorough, providing not only a list of classes offered, but also the prices for those classes and a statement showing that her academy was endorsed by the largest maritime and navigational organizations in Victorian London: the

⁹³ Taylor, Janet. 1846. *Directions for Using the Planisphere of the Stars, with illustrative and explanatory problems*. London: Poplett.; Taylor, Janet. 1847. *Lunar and Horary Tables: with the shortest method of finding the longitude and the time*. 5th ed.; Taylor, Janet. 1847. *Diurnal Register, for Barometer, Sympiesometer, Thermometer and Hygrometer, with a few brief remarks on the instruments*. 2nd ed.

⁹⁴ Reehorst, Karel Pieter Ter. *Mariner's Friend and Technical Dictionary in Ten Languages*. London: Janet Taylor. 1865.

Admiralty, Trinity House, and the East India Company. The hours her nautical academy were in operation each day is also posted as 10 a.m. until 4 p.m. It is made clear that fees are to be paid up front, and that “pupils not having time to complete their studies can return at pleasure- Private Apartments for those wishing to study alone”.⁹⁵ Taylor afforded countless seamen an all-inclusive educational opportunity. Not only could mariners study and board at Taylor’s establishment, but those hoping to become masters and mates could also take classes and prepare for their eventual examinations at her academy. In so far as examinations were given by the Admiralty, it is notable that mariners depended upon the quality of her instruction.

The second advertisement in Reehorst’s book, regarding the sale and publishing of charts and other nautical books, provides a list of Taylor’s most recent works (with several being the latest editions of earlier books). Among this list were: *An Epitome of Navigation* (1842), *Planisphere of the Stars* (1846), *Lunar and Horary Tables* (1854), and the *Handbook to the Local Marine Board Examination* (1860). Each of these titles is followed by a brief description of the book, along with information pertaining to the addition of new material to older editions. The *Handbook to the Local Marine Board Examination*, to take one example, provided questions, mathematical word problems, and answers related to courses taken at Taylor’s nautical academy. These questions and answers were designed to prepare prospective mates and masters for the Admiralty’s official examination.⁹⁶ Several other publications authored by Taylor, though unspecific in date, are listed in the advertisement and reveal the long-standing relationship Taylor held with the Admiralty. *The Seamanship* served a similar purpose as the examination handbook, being “required by the Board of Examiners, arranged in Questions and Answers”. The *Barometric Diurnal Register* (originally written in 1854), allowed mariners to

⁹⁵ Reehorst, Karel Pieter Ter. *Mariner’s Friend and Technical Dictionary in Ten Languages*.

⁹⁶ A later edition of this marine handbook will be discussed in this chapter also; Janet Taylor would go on to produce upwards of thirty of these for the Admiralty.

record “the direction and force of the wind, the state of the weather, &c. on the plan ordered by the Lords of the Admiralty to be adopted for the use of Her Majesty’s Navy”.⁹⁷ While she did not work directly for the Admiralty when publishing Reehorst’s book, it is clear that her reputation among those working within the actual organization was high.

Years of building credibility as a woman in a male-dominated field paid off for Taylor, mainly in fresh opportunities to advance her career as an author. In 1860, for example, she was tasked with writing the highly detailed handbook that would prepare future mariners, particularly masters and mates, for their examinations (taken through the Admiralty). Entitled *Hand-Book to the Local Marine Board Examination, for the Officers of the British Mercantile Marine: Including the New Regulations for Masters and Mates in the Coasting Trade. A Diagram Illustrating Current Sailing, and Directions for Working the Tides; with Full and Complete Answers to the Questions in Steam*, this book is further evidence of her standing in the eyes of the Admiralty. Her reputation with the Admiralty being built on her written word is significant in the context of the Victorian era, where most men within this organization built their reputations based on the experiences they had physically aboard vessels at sea.

Her lack of experience aboard both sailing and steamships was something Taylor had to acknowledge and then rebuttal. At the beginning of the *Hand-Book to the Local Marine Board Examination*’s preface, Taylor tells her readers what to expect of this book: “on examination of the work, it will be found to contain all those Questions and Exercises in Navigation and Steam, requisite in preparing for the different grades in the profession,- independent of Seamanship, a knowledge of which can only be acquired by service at sea*.”⁹⁸ While the actual practice of

⁹⁷ Reehorst, Karel Pieter Ter. *Mariner’s Friend and Technical Dictionary in Ten Languages*.

⁹⁸ Taylor, Janet. *Hand-Book to the Local Marine Board Examination, for the Officers of the British Mercantile Marine: Including the New Regulations for Masters and Mates in the Coasting Trade. A Diagram Illustrating*

“seamanship” can only be attained through experience on the water, it can still be described in order to educate those looking to acquire the requisite knowledge and eventually pass their examinations. Taylor makes this clear when she writes that “Mrs. Janet Taylor has published a work on Seamanship, by Capt. Liddle, which contains all the required answers in Seamanship, in which great care has been taken not to overburden the memory by useless matter, but just give such brief information as will help the pupil to put his own ideas into fitting words”.⁹⁹ Taylor believed that what she lacked in practical experience, she more than made up for with theory.¹⁰⁰

Taylor also used her *Hand-Book to the Local Marine Board Examination* as an advertising opportunity, much like she did when she published Karel Pieter Ter Reehorst’s *Mariner’s Friend and Technical Dictionary in Ten Languages*. This marine handbook did come out before Reehorst’s dictionary, but highlights many of the same titles: *An Epitome of Navigation*, the *Lunar and Horary Tables*, *Planisphere of the Fixed Stars*, and the *Barometric Diurnal Register* are just a few examples. The descriptions of her works are very similar to the descriptions found in Reehorst’s book, but do give more details on the prices, which range from two to ten shillings. Taylor also provided two reviews of *An Epitome of Navigation* after providing her own description of it. Providing these reviews reveals to mariners the credibility of the newest edition of this book without them having to take only her word for it. The following review is what Taylor describes as an “Extract from the Shipping Gazette”:

In the work we recognize all the Tables that are familiar to the mariner, but they are presented in a very much improved shape, which the ample size of the book allows them to appear in; to the Tables it gives a great facility of reference, and this is a matter of much importance. The rules by which the young sailor is to be

Current Sailing, and Directions for Working the Tides; with Full and Complete Answers to the Questions in Steam. London: Janet Taylor. 1860. iii.

⁹⁹ Taylor, Janet. *Hand-Book to the Local Marine Board Examination*. iii.

¹⁰⁰ Taylor’s role as an educator is also evident here, because she states that her work will benefit current and future sailors by helping “the pupil to put his own ideas into fitting words”; or to rephrase, develop critical thinking skills that will help one at sea.

directed in the attainment of the useful knowledge, which is indispensable to his success in his future career, are clearly laid down, and examples under each rule are provided.¹⁰¹

What this review sought to portray about the newest edition of *An Epitome of Navigation* was that it simplified the tables and mathematical calculations important to all seamen, organizing and presenting them in a way that makes it less difficult for mariners to first learn, and then use efficiently once at sea. Taylor claimed that her book does exactly this in her own description of it, claiming that “in every case the simplest as well as the most approved rules are adopted”.¹⁰² Taylor also must have been vaguely aware of how her own gender is set apart from the field in which she works throughout this review, given the fact that the “young sailor” is characterized only as male. This social divide aside, Taylor was determined, and successful in, establishing herself as a reputable author and publisher throughout the mid-nineteenth century.

She began her career as an author in 1833 with the publication of her *Luni-solar and horary tables*, but this career would follow her for decades, well into the 1860's. Her *Planisphere of the Stars*, for example, was originally published in 1846 but praised by Arthur Young in his 1863 publication, the *Nautical Dictionary: Defining the Technical Language Relative to the Building and Equipment of Sailing Vessels and Steamers, Seamanship, Navigation, Nautical Astronomy, Naval Gunnery, Maritime Law and Commerce, general and Particular Average and Marine Insurance, and Other Terms Relating to Maritime Affairs*. In his section on nautical astronomy, Young writes that “notice may here be taken of a publication by Mrs. Janet Taylor, London, which appears to be a very useful one: namely, *A Planisphere of the*

¹⁰¹ Taylor, Janet. *Hand-Book to the Local Marine Board Examination*. 143.

¹⁰² Taylor, Janet. *Hand-Book to the Local Marine Board Examination*. 143.

Stars on a black ground: exhibiting a view of the heavens in three maps, with the distances, magnitudes, and relative positions of the fixed stars".¹⁰³ The respect Young has for Taylor's work is also made evident in his preface, where Taylor is the only woman out of ten people listed in Young's "acknowledgement of useful assistance formerly rendered"; she is also the only one listed who is not a captain or a master for the navy.¹⁰⁴

Developing a career as a woman author and publisher was hard enough during the Victorian period, let alone establishing oneself as a female author and publisher on topics that were considered to be discussed or written about by a predominantly male demographic. However, Janet Taylor was able to transcend these gender-based restrictions and both wrote her own books and published for others (who were all men) works on a myriad of subjects related to maritime and navigational practices. Her mathematical genius, and her ability to write in a way that made this math attainable to the common mariner, gained her substantial credibility among both the common mariner and the most notorious maritime organizations to exist during the Victorian era: the Admiralty, the Trinity House, and the East India Company.

¹⁰³ Young, Arthur. 1863. *Nautical Dictionary: Defining the Technical Language Relative to the Building and Equipment of Sailing Vessels and Steamers, Seamanship, Navigation, Nautical Astronomy, Naval Gunnery, Maritime Law and Commerce, general and Particular Average and Marine Insurance, and Other Terms Relating to Maritime Affairs*. London: Longman, Green, Longman, Roberts, & Green. 19.

¹⁰⁴ Young, Arthur. *Nautical Dictionary*. III.

Chapter 3

The Instrument Maker

In addition to her roles as an educator and an author, Janet Taylor was quite the accomplished instrument maker. The instruments she invented or innovated were consistently well-received by the publications that praised her written works, and in several cases would be exhibited at large public events, put on to highlight the inventions and inventors taking part in the industrial revolution. This chapter will argue for the significance of Taylor's career as a maker of nautical instruments, countering the historiographical error that currently exists about the breadth of her impact and revealing the significance of her most ambitious project; the mariner's compass. Despite early accounts that stressed her husband's influence, he played no significant role in her careers as an author or inventor and seller of nautical instruments. If anything, Taylor's career and reputation only increased in scope and impact in the years following her husband's death. For example, an advertisement in 1854 (shortly after her husband's death) listed, as part of her business,

Manufacturer of every description of nautical and mathematical instruments ...
Barometers, Air & Water Thermometers, Areometers, Hygrometers, & all kinds
of Meteorological Instruments, Especially made and adapted for Sea use, with the
particular Scales as required conformable to the Regulations adopted by LIEUT.
MAURY, and the Members of the "Maritime Conference," for the purpose of
carrying out an uniform system of Meteorological Observations at Sea.¹⁰⁵

Taylor had been able to extend beyond her career as an educator and author, establishing herself as a prominent instrument maker and adjuster. This career begins in the 1830's when she became a chart and instrument seller; advertisements for her own chronometers appear in the *Shipping and Mercantile Gazette* as early as 1838.¹⁰⁶ While Taylor had begun this part of her career shortly after the founding of her nautical academies in the 1830's, advertisements and reviews

¹⁰⁵ *Mercantile Marine Magazine*. October 1854. 45.

¹⁰⁶ "Chronometers". 12 September 1838. *Shipping and Mercantile Gazette*.

for her navigational instruments and charts become especially prominent in the 1850's. For example, the *Nautical Standard* began frequently describing Taylor as an "agent" in selling charts for the Admiralty in 1852. In August they began listing her alongside Masters, captains, and shipbuilders' services.¹⁰⁷

Becoming noteworthy in the industry of both creating and selling nautical instruments began as did her career as an author, with a mathematical breakthrough based on the earth's true shape. It was the use of fruit as a representation of celestial bodies, a concept taught to her by her father, that led Taylor to the realization that the earth was not perfectly spherical, but rather spheroidal, meaning that it is ever-so-slightly elongated at the ends.¹⁰⁸ This navigational breakthrough would allow for much more accurate calculations of longitude for mariners at sea. Taylor would also use her astronomical expertise not only to write about the ways in which the spheroidal shape of the earth needed to be taken into account when locating position at sea, she also created and adjusted compasses, octants, sextants, binnacles, charts, and many other nautical tools in order to make them compatible with these new mathematical principles. This type of innovation in navigation was crucial to England during the industrial revolution. The maritime industry needed to keep up with the expansion happening inside and outside of the nation, and Taylor helped facilitate this relationship. Taylor's most notable invention, the mariner's compass, is symbolic of this time period as it conveys the progressive thinking of Taylor, and inventors generally, during this era. It reflected principles emphasized by the industrial

¹⁰⁷ "Janet Taylor's, 104, Minorities, Agent for London". 31 January, 1852. *Nautical Standard*.; "Janet Taylor's, 104, Minorities, Agent for London". 29 May, 1852. *Nautical Standard*.; "Janet Taylor's, 104, Minorities, Agent for London". 7 August, 1852. *Nautical Standard*.; "Janet Taylor's, 104, Minorities, Agent for London". 16 October, 1852. *Nautical Standard*.

¹⁰⁸ To reiterate the first chapter of this thesis; it was her education, which she both gave and received, that enabled her success and allowed her to become such an accomplished expert in making navigational tools using astronomy, mathematics, and her own two hands.

revolution, notably a rise in technology (and those trying to create it), and the need for new technology to advance society.

The mariner's compass, combining several simpler navigational tools into one, was meant to “combine the means of making observations, with the power of giving solutions to all problems in Nautical Astronomy, without the use of a single calculation, or log”.¹⁰⁹ While it functioned correctly and received a patent in 1834, it would ultimately not be endorsed by the Admiralty, nor would it become a commonly used tool among Victorian seamen. An examination of this tool and Taylor's other inventions and products will reveal the ways in which she reflected the nature of this industrious society. Taylor was often a step ahead of her own field, as an analysis of the mariner's compass and her many other instruments will indicate.

Shortly after her first book was published in 1833 (her *Luni-solar and horary tables*), Taylor decided to put her new mathematical theories into practice by inventing an instrument that would allow mariners to perform a multitude of calculations at once.¹¹⁰ Most simply put, this instrument, which Taylor called the mariner's compass, “was an intriguingly clever concept, combining an instrument of double reflection, like a sextant, with a mechanical means of solving spherical triangles, the essence of calculating longitude”.¹¹¹

¹⁰⁹ Taylor, Janet. *Idem, The Principles of Navigation Simplified, with Luni-Solar and Horary Tables*. London. 1837.

¹¹⁰ The list of calculations combined into the mariner's compass includes finding the true Time; the true Altitude; the true Azimuth; the Latitude by double Latitudes and elapsed Time; a Lunar Distance, as in the Nautical Almanac; the distance between any two Places; the Bearing of One from the Other; and the differences of Longitude. Croucher, John S. and Rosalind F. Croucher. *Mistress of Science*. 69.

¹¹¹ Croucher, John S. and Rosalind F. Croucher. *Mistress of Science*. 68.

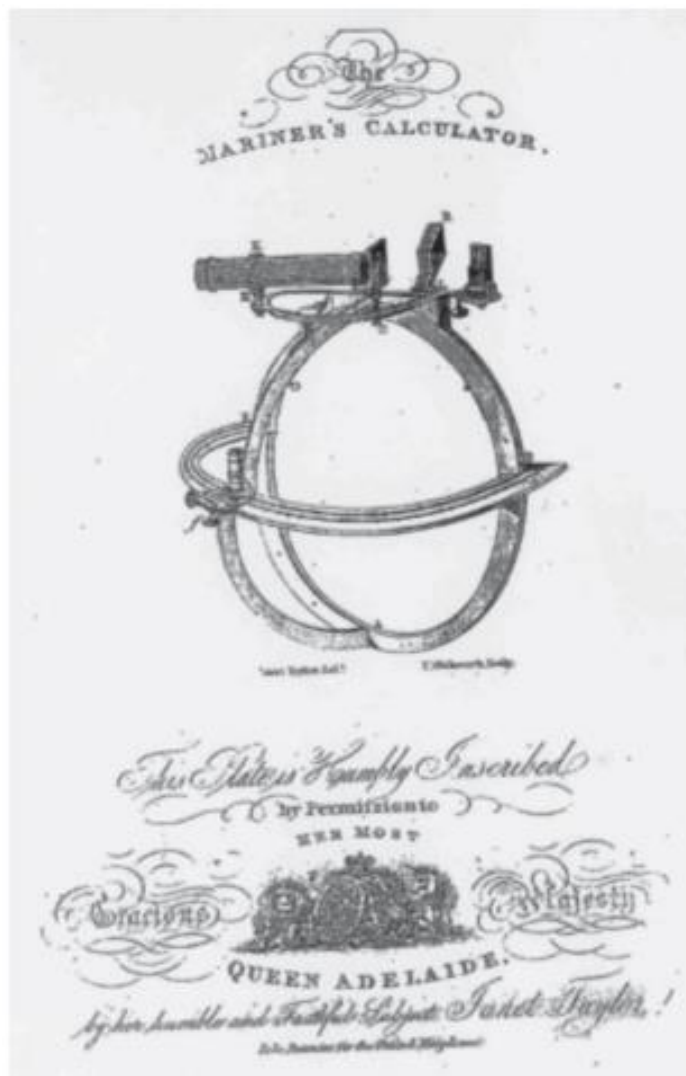


Figure 2. This image of the mariner's compass can be found on the inside cover of Janet Taylor's 1834 edition of her *Lunar Tables*.

The mariner's compass is representative of the industrial revolution of which Taylor was a tiny part. It combined new and more precise mathematical calculations with several nautical instruments, all of which were essential to navigating the seas. The mariner's compass, while an innovative tool for the period, was, in a way, a step ahead of its time. While it worked in theory, its usefulness to the seamen having to deal with the tumults of sailing the ocean was a topic of debate, particularly among members of the Admiralty such as Francis Beaufort.

Like many Victorian seamen, Francis Beaufort worked his way up through the ranks to captain in the Royal Navy, beginning as a midshipman with the East India Company. In 1829, he

would be appointed the head of the Admiralty's Hydrographic Office; it is in this position Beaufort would find himself in charge of assessing the mariner's compass. It took Beaufort two months to complete his assessment, which was not kind:

...if it were well made and the results accurate, the difficulty which the clumsy fingers of seamen would find in small measurements with compasses and the impracticability of measuring circular arcs would always render it objectionable. Even if the Instrument performed all that is stated it is not worthy of their Lordships patronage from the mischievous tendency which it evidently has of inducing a slovenly and empirical mode of working observations and leaving the operator totally in the dark as to the reason of his proceeding.¹¹²

Beaufort's assessment as a whole alludes to the fact that Taylor's newest invention had been hastily developed but did technically still work in theory. The real problem, however, would come from those who would need to use it. Between their "clumsy fingers" and inability to comprehend the concept of combining multiple mathematical principles into a single step would cause this instrument to have very little practical value at sea. But had Beaufort given the mariner's compass a fair assessment? Considering the personal turmoil he had been experiencing during this time, his assessment of Taylor's invention may have carried a bias against her.

Beaufort may have been unfit to assess Taylor's invention due to the deteriorating health of his wife throughout the entire year of 1834, with her passing happening in August of that year; this would take place only three months after Taylor received his negative review of her invention. Beaufort was aware of Taylor's home and family life, cognisant of the fact that she was a wife, and mother, herself, having worked with her husband before the beginning of their own professional relationship. Losing this same role in his own home and family life may have affected his judgement of Taylor and her work. With his own children motherless, Beaufort may have been critical of Taylor's presence in the public sphere to which most middle-class women were restricted. The state of the home (the private sphere) was the undertaking of the wife, who

¹¹² Admiralty Minute Book. 2 May 1834. Croucher, John S. & Rosalind F. Croucher. *Mistress of Science*. 71.

was “responsible for creating an atmosphere of comfort and gentility, or for failing to create it”.¹¹³ In being a wife, mother, and businesswoman, Taylor was able to occupy both spheres, though Beaufort may have viewed her as working solely within the wrong one.

Perhaps in this state of mind Beaufort saw Taylor as distancing herself from her family and domestic life in trying to penetrate this male-dominated field, a pain he had felt and could spare others of. While there is no documentation to prove, or disprove, this notion, Taylor would be awarded a patent from the Admiralty for her mariner’s compass in September, one month after the passing of Beaufort’s wife. While Beaufort’s assessment meant that Taylor did not receive the support of the entire Admiralty, the patent she was given reveals that this invention was respected by some within the department. Taylor would be the only woman recorded as a patent holder with the Admiralty for a two hundred year span. Her name can still be found next to those glorified throughout maritime history, such as John Hadley, whose mathematical and astronomical principles served as a basis for her own work. Regardless of Beaufort’s initial negativity (which would fade with future engagements with Taylor), Taylor would continue to pursue the development and distribution of her mariner’s compass.

Despite his initial disapproval of Janet Taylor’s work in the 1830’s, particularly in regard to the mariner’s compass, Sir Francis Beaufort would in fact grow fond of Taylor and the contributions she provided to both the Admiralty as an organization and London’s maritime community as a whole. While Beaufort had worked with Taylor’s husband George extensively before their own relationship was established, much of this reconciliation would happen through the words of Sir George Biddell Airy, Astronomer Royal from 1835 to 1881. Airy was not only close friends with Beaufort, but also held a deep regard for Taylor as an astronomer, given her support of his work. This support is shown through extensive written correspondence between

¹¹³ Gorham, Deborah. *The Victorian Girl and the Feminine Ideal*. 10.

the two throughout the 1850's. The relationship between Taylor and Beaufort would only improve following Airy's choice to forward this correspondence, and his own regard for Taylor, to Beaufort at the Admiralty's Hydrographic Office. An 1857 letter correspondence between Taylor and Beaufort reveals his concern for Taylor and her family. In the midst of working together on the creation of some Admiralty charts, Taylor had to attend to her children, who had become ill during a typhoid outbreak. Taylor explains her absence to Beaufort: "My young family have been ill for some week's past... unlike a lady you once named to me, who by magnetism or some other ism, communicate maternal care and attention to her children though separated from them, my mind and personal attendance have been accorded to them night and day".¹¹⁴ Taylor finished her letter by assuring Beaufort that she had not been "idle" in her "literary duties". Beaufort replied immediately, sending a letter the next day that rejoiced in the improved health of her children. In this rejoice, Beaufort eagerly awaits Taylor's return to work, admitting that the health of her children is good because it "enables her to resume her industrious pursuits- and will be glad to see the results of her labour".¹¹⁵

In the meantime, Taylor would further establish herself as an inventor and innovator of nautical tools to the maritime community; her attention to detail was as diligent as her focus on mathematical and technological concepts. The aesthetic nature of Taylor's instruments is representative of many high-end instruments created for celestial navigation during the Victorian era. The quintant pictured below, for example, was developed and designed by Taylor in 1850 specifically for the Prince of Wales, who later would become King Edward VII. This quintant is

¹¹⁴ Rose, Laura. *Poppy's with Honour*. 2014. AuthorHouse Publishing. 244 pp. 85.

¹¹⁵ Rose, Laura. *Poppy's with Honour*. 85.

unique because it combines the floral-style common to the nautical instruments of this time¹¹⁶ with Prince Edward's three-feathered family crest; the floral pattern being on the bottom and the familial crest situated at the top. In this way, Taylor's design goes beyond the norm, becoming a tool with a special (indeed royal) sense of individuality. Not only is this gift from Taylor to the Prince of Wales a practical tool of celestial navigation, it is a work of art and a tribute to a family within the English nobility. This quintant combines beauty with mathematics and astronomical genius, and lest Edward forget who made such a fine item, a cursive signature is engraved along the bottom of the graduated arc: Mrs. Janet Taylor, 104 Minories London. Other members of the royal family would also own quintants made and decorated by Taylor.¹¹⁷

¹¹⁶ Bruyns, W.F.J. Morzer & Richard Dunn. 2009. *Sextants at Greenwich; A Catalogue of the Mariner's Quadrants, Mariner's Astrolabes, Cross-staffs, Backstaffs, Octants, Sextants, Quintants, Reflecting Circles and Artificial Horizons in the National Maritime Museum, Greenwich*. Oxford University Press. 323 pp.

¹¹⁷ Bruyns, W.F.J. Morzer & Richard Dunn. *Sextants at Greenwich*. 10.

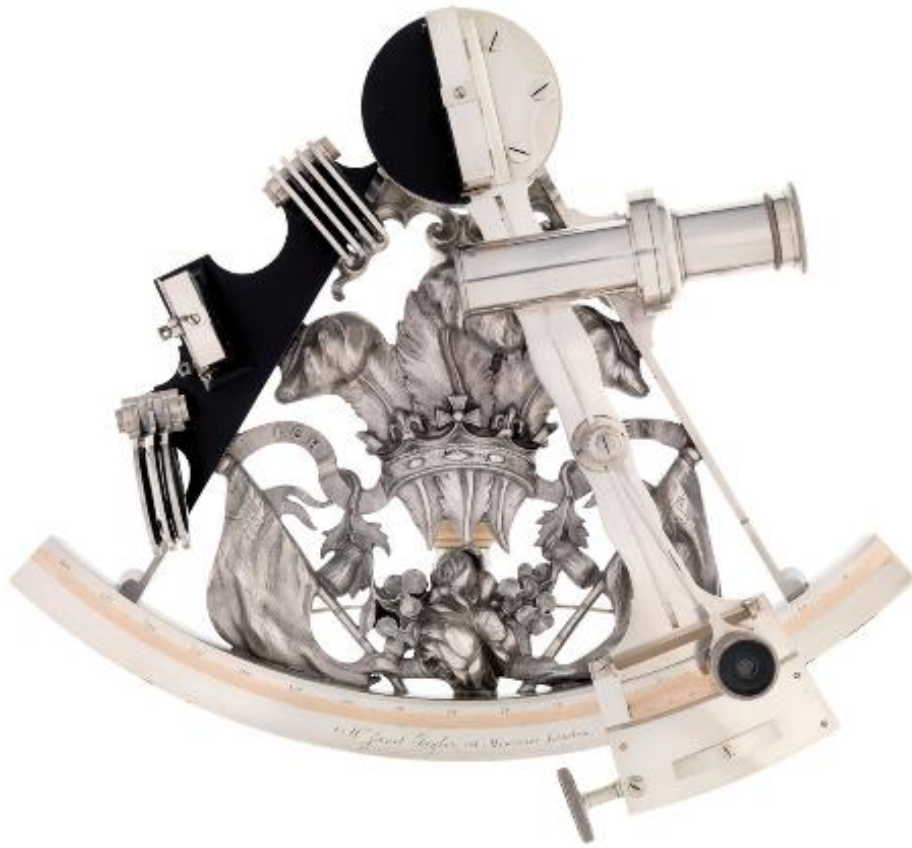


Figure 3. Quintant made by Janet Taylor, circa 1850. From Bruyns & Dunn's 2009 publication *Sextants at Greenwich* (page 338). This quintant can be found in the National Maritime Museum in Greenwich: (cat. no. 281); F6415-001, NAV 1135.

The aesthetic value of Taylor's quintant is not the only notable aspect about it. When placed within the historical context of England's industrial revolution, this quintant becomes a symbol of the technological and societal innovations so characteristic of the period. Throughout the nineteenth century, English society advanced in a myriad of ways; textile industries became mechanized, water power was replaced with steam, wooden ships became laden with iron. Enamored with the rise in industry, not only in England but across the globe, Prince Albert was inspired to host the Great Exhibition of 1851. This context would set the scene for Taylor, one woman among 15,000 inventors and contributors presenting a total of 100,000 objects from around the world. By the end of this event approximately six million people would have walked

through the multitude of exhibits, including Queen Victoria (and wife of Prince Albert) herself.¹¹⁸ Taylor was registered as exhibitor number 105 in Class 8: Naval Architecture, Military Engineering, Guns, Weapons, Etc. In a sea of men presenting their nautical instruments, Taylor could be found with her “bronze binnacle, with compass, designed from the water lily”.¹¹⁹ This record of Taylor’s appearance at the Great Exhibition reveals that her work was not only intriguing to potential customers, but the general public as well, considering the massive, diverse audience at events such as this one.

In addition to the elaborate one entered in the Great Exhibition of 1851, Taylor developed and improved many binnacles¹²⁰ by performing hundreds of experiments which consisted of swinging ships back and forth across the Thames and recording the subsequent compass actions. Taylor explains the results of these experiments in an 1854 letter to Sir George Airy, Astronomer Royal at the Royal Observatory in Greenwich. When compasses were housed in binnacles mounted a few feet above deck, there was little deviation or error, “but in skylight compasses and those placed low for *convenience*, a *grave* to consideration Merchant ships, serious errors have arisen from the needles being brought in close contact either with iron (beams), or the magnets used to correct original errors on the horizontal”.¹²¹

Taylor proceeded to tell Airy that his method of correcting compass errors had proved most effective in her experiments. Airy would be skeptical of Taylor’s credibility at first, but he was quickly reassured of her expertise by friend William Beechey, a former admiral in the Navy and the first superintendent of the Board of Trade’s Marine Department. Beechey congratulated

¹¹⁸ Picard, Lisa. 14 October 2009. “Victorian Britain: The Great Exhibition”. British Library. <https://www.bl.uk/victorian-britain/articles/the-great-exhibition>

¹¹⁹ Great Exhibition London, England. 1851. *Official catalogue of the Great exhibition of the works of industry of all nations, 1851*. 2nd ed. London: Spicer Brothers. 320 pp. 49.

¹²⁰ Binnacles are effectively the compartment that holds a compass steady as a ship moves.

¹²¹ Letter from Janet Taylor to Sir George Airy, 30 November 1854. Croucher, John S. and Rosalind F. *Mistress of Science*. 204.

Airy on this display of support for his work from Taylor and revealed the respect he had for her; “Mrs Janet Taylor’s letter must be gratifying. I rejoice, she is a very sensible person. She has her work executed by a man who she keeps in her employ for this purpose”.¹²² Fully convinced of her credibility from that point on, Airy would go on to work with Taylor multiple times throughout the remainder of his career, to the benefit of them both.

As her correspondence with Airy reveals, Taylor shows her authority in the instrument making field through her public support and endorsement of men conducting the same type of business. In 1854 Taylor would write a letter to the editor of *The Mercantile Marine Magazine and Nautical Record*, with the goal of endorsing the work of a Mr. Hartnup by supporting his findings in chronometer alterations, using the results of her own experiments. She began by expressing her pleasure with Mr. Hartnup’s letter in the last volume of the magazine, which “laid before the public his Observations on the Compensations of Chronometers, and has called attention to the great variation of their rates under change of temperature”.¹²³ She explained how her experiments had supported his claims, and in doing this shows her innovative nature. In order to conduct her experiments with chronometers, Taylor claimed to have “had an apparatus constructed, by which I could try them from 20° to 120°”.¹²⁴ Her persistent work in this area, from her perspective, deserved more recognition. Taylor ends this letter to the editor by making it clear that she is producing credible and important work, right alongside men such as Mr. Hartnup:

That gentleman, when he said “I am not aware of the existence of any other establishment in the world in which captains of merchant ships can obtain any

¹²² Letter from William Beechey to Sir George Airy, December 1854. Croucher, John S. and Rosalind F. *Mistress of Science*. 206.

¹²³ Taylor, Janet. “To the Editor of the Mercantile Marine Magazine: Rates of Chronometers”. 16 November 1854. *The Mercantile Marine Magazine and Nautical Record*. 464.

¹²⁴ Taylor, Janet. “To the Editor of the Mercantile Marine Magazine: Rates of Chronometers”. *The Mercantile Marine Magazine and Nautical Record*. 464.

information relative to the variation of the rates of their chronometers in different temperatures,” did not know that I had been travelling on the same path with him- and I can only add, in conclusion, that I shall be happy at all times to test captains’ chronometers at any degrees of temperature they may require.¹²⁵

Had this gentleman known authorities in astronomy and instrument making, such as Airy, his lack of knowledge concerning Taylor and her business may have changed. Even had he read their works, he would have seen her name. Airy, in fact, happened to be the author of the “Rates of Chronometers on Trial for Purchase by the Board of Admiralty, at the Royal Observatory, Greenwich” in an 1857 volume of *Greenwich Observations in Astronomy, Magnetism and Meteorology made at the Royal Observatory*. Listed third out of twenty, Taylor described her chronometer as “A double action balance of original construction”.¹²⁶ She is the only female inventor listed, and the only one listed using a name prefix (Mrs.). This publication by Airy reveals the influence of Taylor’s reputation and the words of men such as Beechey, as this work was published within a few years of that previously discussed correspondence between Taylor and Airy.

Another type of nautical instrument invented by Taylor that received attention in the early 1850’s was her “new sea artificial horizon”, an attachment for sextants and quadrants. This instrument was invented by Taylor in 1856, shortly after the opening of her second nautical academy. An 1856 edition of the *Mercantile Marine Magazine and Nautical Record* is provided

¹²⁵ Taylor, Janet. “To the Editor of the Mercantile Marine Magazine: Rates of Chronometers”. *The Mercantile Marine Magazine and Nautical Record*. 464.

¹²⁶ Airy, George Biddell. 1857. “Rates of Chronometers on Trial for Purchase by the Board of Admiralty, at the Royal Observatory, Greenwich”. *Greenwich Observations in Astronomy, Magnetism and Meteorology made at the Royal Observatory*. Series 2, vol. 17, pp.F1-F6/F7. F2.

by the Crouchers in *Mistress of Science*, showing readers the warm reception this instrument received from the start:

SEVERAL attempts have been made of late years to supply an artificial horizon of such a character as to be adapted for use on board ship. It is probable that nothing will be found so effectual for the purpose as the simple contrivance to which we here draw attention, and which has been brought out by Mrs Janet Taylor, 104, Minories, London.¹²⁷

Shortly after this initial review of her instrument, more individual accounts of mariners using this tool began to flood maritime publications such as the *Mercantile Marine*. J.R. Luckes, a master aboard an iron barque by the name *Rosario*, represents the consensus on Taylor's artificial horizon.

As I believe you take a great interest in whatever benefits the Mercantile Marine, I would beg to call your attention to the Artificial Horizon, lately brought out by Mrs Janet Taylor. I have used it and found it of the greatest advantage in Navigation; indeed I prefer it to any other instrument of the kind, as I believe it to be (from experience) more accurate.¹²⁸

Luckes' experience shows that while Taylor was not physically aboard these vessels, she was surely having a positive effect on their travel. Taylor's innovative tools would continue to gain popularity into the 1860's.

In 1862, Taylor would again find herself presenting her nautical instruments at a world renown exhibition: the 1862 London International Exhibition of Industry and Art. Registered as exhibitor number 2819, Taylor presented two instruments this time; a sextant and her mariner's compass, as part of "Class 12: Naval Architecture- Ships' Tackle".¹²⁹ She also presented an original lantern in the class following this one, categorized as "Philosophical Instruments and

¹²⁷ Croucher, John S. and Rosalind F. Croucher. *Mistress of Science*. 219.

¹²⁸ Croucher, John S. and Rosalind F. Croucher. *Mistress of Science*. 220.

¹²⁹ London International Exhibition. 1862. *Official catalogue of the industrial department*. 3d ed. London: Printed for Her Majesty's commissioners, by Truscott, son & Simmons. 46.

Processes Depending Upon Their Use”.¹³⁰ The sextant was the most well-received by the public because of the innovation it showed in minor mirror adjustments.

While Taylor was not the original inventor of the sextant, she made innovative advancements in its technology. Before Taylor began her career in the advancement and invention of navigational instruments, the average sextant could only measure observations up to 120°. This is because the mirror placement on sextants would restrict its movement, putting a limit on the calculations that could be made. Taylor, however, found a way to surpass this restriction by moving the location of the mirror. The juror’s report for the International Exhibition of 1862 describes this innovation: “Mrs. Taylor takes advantage of the fact that, at these high angles, the reflection from the index-glass is almost wholly directed from its face, few rays reaching its silvered back. She therefore places the index-glass so that its face, and not its back, stands above the axis of the sextant. Angles can thus be taken until the index of the index-glass is found to be too much foreshortened to continue practically available”.¹³¹

According to this juror’s report, Taylor’s sextant adjustment afforded those calculating an angular distance between any two objects an extra 15° to 25°, allowing the tool to be used up to a 145° angle. I provide a 10° margin of error because of a mathematical typo made in the report when discussing the significance of Taylor’s work here: “Trial was made at the Kew Observatory, and an angle of 145° was found perfectly practicable under favourable circumstances. This addition of 15° to the range of a sextant is very important to observers on shore who use the ordinary artificial reflecting horizons, and can therefore take the altitude of no that exceeds *half* the range of the sextant”.¹³² An increase in range from 120° to 145° has a difference of 25°, and not 15°; but that specific mathematical calculation is not what mattered.

¹³⁰ Croucher, John S. and Rosalind F. Croucher. *Mistress of Science*. 231.

¹³¹ Weltausstellung. *International Exhibition, 1862: Juror’s Reports*. London: Bell & Daldy, Fleet Street. 1862. 15.

¹³² Weltausstellung. *Juror’s Reports*. 15.

What does matter is that the work contributed by Taylor influenced the lives of mariners measuring distance, both at shore and at sea.

This debut of the mariner's compass at the 1862 exhibition would not bring it the popularity she had hoped for, but it did still receive some favorable reviews. An 1862 volume of *The Nautical Magazine and Naval Chronicle* serves as one example, stating that "Mrs. J. Taylor [2,819] exhibits a good liquid compass, fitted in a low binnacle, which latter will no doubt attract the attention of yachtsmen from the neatness and compactness of the design".¹³³ While reviews such as this one endorsed Taylor's newest invention, others were skeptical of the possible contribution it could make to Victorian mariners. *The illustrated record of the international exhibition* used the positive review mentioned above against Taylor. It groups her with other presenters at the exhibition who failed to impress the author. The author does her an additional disservice by mistaking her gender and referring to her as a man (this also reduces the credibility of his word, being unable to correctly identify Taylor):

Compasses for nautical purposes must be mentioned among the omissions which the jealous apprehensions of inventors failed to supply; for, although Mr. J. Taylor exhibited a good Liquid Compass, fitted in a low binnacle, and well adapted for yachtsmen; and Mr. Gowland exhibited the introduction of the Vertical Card... and the Lord of the Admiralty exhibited the model of a Binnacle... there was a failure to display the most efficient compasses for supplying the want which has grown up in this "iron age" of shipbuilding.¹³⁴

The authors of this work, T.P. Shaffner and W. Owen, were obviously dissatisfied with Class 12 of the exhibition as a whole, a reflection of Beaufort's original condemnation of her invention. It is interesting to note, however, that Shaffner and Owen disagree with Beaufort's consensus,

¹³³ *The Nautical Magazine and Naval Chronicle for 1862*. 2013. Reprinted by Cambridge University Press. 724 pp. 582.

¹³⁴ Shaffner, T. P. (Taliaferro Preston), Owen, W. 1862. *The illustrated record of the international exhibition of the industrial arts and manufactures, and the fine arts, of all nations, in 1862: in a series of tinted steel engravings, comprising views of the building, and of the principal objects exhibited, also, several views of the exhibition of 1851, from daguerreotypes taken at the time, forming a commemorative work of the two great exhibitions of the world's industry in 1851 and 1862, with historical and descriptive letterpress*. London: London Printing and Publishing Company. 67.

claiming that Taylor's mariner's compass was "well adapted for yachtsmen". Given the several instances in which Taylor's instruments were not met with quick success, her reputation continued to gain momentum throughout the 1860's.¹³⁵

Arthur Young cited Taylor as the latest innovator of the modern binnacle in his *Nautical Dictionary* (1863). After defining and explaining the process of using a common binnacle, Young depicts how Taylor's goes a step beyond the norm: "There is a new kind of *binnacle lamp*, invented by Mrs. Janet Taylor, 104 Minories, London, having a parabolical reflector placed above it, which throws the light brilliantly over the compass card; this lamp is said to burn with a steady light, and to save about two-thirds of the oil usually consumed".¹³⁶ The only other mention of innovation in the production of binnacles by Young is that "there are compasses made of amber for night service". As she did with her sextants in correcting arc errors, Taylor took the common binnacle and made it better, in this case making the light more reliable and the amount of oil needed to use it less. Her binnacles were therefore more efficient than those that came before hers.

As an astronomer and innovator in the development of navigational instruments, Taylor was also highly respected by scientific observatories, like the Kew Observatory mentioned above. Located in the heart of Richmond, London, the Kew Observatory was a notable authority in both astronomical and nautical practices during the Victorian era. Those working within the organization kept close relations with, and frequently published pieces in both nautical and scientific magazines. This excerpt from a Kew Observatory employee's letter, published in an

¹³⁵ "The Civil List" 2 January, 1860. *Bell's Weekly Messenger*. London.; "In consideration of her benevolent labours among the seafaring population of London". 4 August, 1860. *London Stratford Times and South Essex Gazette*. London.; "Shipping Intelligence". 12 November, 1864. *Liverpool Daily Post*. Lancashire.; "Lloyd's Register of British and Foreign Shipping. Iron Ships. Roles and Regulations". 19 January, 1866. *Lloyd's List*. London.

¹³⁶ Young, Arthur. 1863. *Nautical Dictionary: Defining the Technical Language Relative to the Building and Equipment of Sailing Vessels and Steamers, Seamanship, Navigation, Nautical Astronomy, Naval Gunnery, Maritime Law and Commerce, General and Particular Average and Marine Insurance, and Other Terms Relating to Maritime Affairs*. Longman, Green, Longman, Roberts, & Green. 492 pp. 39.

1884 volume of *Nature: International Journal of Science*, reveals the importance of astronomers in the advancement of sextants; “In your review of ‘Encyclopaedia Britannica’ published last week I notice that reference is made to an article on navigation by Capt. Moriarty, and attention is called to the very serious error in sextants arising from false centering. Having had some experience in the examination of these instruments, I can practically testify to this most important defect”.¹³⁷ The author claimed that sextants belonging to members of the mercantile marine, and developed by notable instrument makers, had come to the Kew Observatory needing repairs due to “arc error” and false centering. While admitting this is a rare circumstance, the end of the letter reveals “how few these are in comparison with the hundreds of inferior instruments that pass into the hands of the public without being tested”.¹³⁸ According to the experiments done by the Kew Observatory (and discussed above), Taylor’s sextants were among the “superior sextants by first-class makers” that rarely, or never, hindered mariners’ calculations because of arc errors and false centering.

Considering her established reputation among the astronomical and maritime communities of Victorian London; how could have Taylor’s largest undertaking, the mariner’s compass, been so ill-received by both Beaufort and those who reviewed the 1862 exhibition? It had been based on mathematical principles that she had proven were more accurate than ever before. According to a reconstruction and reassessment of the mariner’s compass done in 2005, the problem with this instrument stems from Taylor’s lack of onboard experience. Ron Robinson, a leader in Britain’s modern compass adjusting, had findings similar to that of

¹³⁷ Baker, T.W. “Sextants”. *Nature: International Journal of Science*. Vol. 30;776. 11 September 1884. 464.

¹³⁸ Baker, T.W. “Sextants”. *Nature*. 464.

Beaufort, but certainly gave Taylor more credit for the ingenuity and talent she exhibited in creating this instrument. After having trouble recreating the instrument (patents during that time often left out small details to inhibit others from stealing the work and ideas of others), Robinson concludes that when built to her specifications, the mariner's compass would in fact work: "There is no part of her written instructions that is fundamentally flawed. She followed the laws of geometry absolutely. It's clear to me that she had an absolute and clear grasp of her subject: total-sufficient to write competently about it. I am unaware of any serious holes that were poked in her theory".¹³⁹

The only shortcoming mentioned by Robinson in his reassessment of Taylor's invention is that she did not take into account the conditions experienced by men at sea, and the abilities that they themselves held. This may support Beaufort's original finding, but Robinson is clearer about why this was not the right time to introduce the compass to English mariners when he states "With the arrival of steamships, apart from the ship rolling and pitching, you have a reasonable platform from which to make your observations. But with a sailing ship-when the sails are full-it's a different matter, and you don't have the advantage of electric light".¹⁴⁰ Had this invention come at a later date, when steamships were more plentiful and therefore provided more stability on the water, perhaps the "clumsy fingers" Beaufort described would be better able to use an instrument more complicated than its long-used predecessors.

Since the modern assessment of the mariner's compass was conducted, a few historians have at least paid her minimum attention. W.F.J. Mörzer Bruyns and Richard Dunn do this in their recent book *Sextants at Greenwich: A Catalogue of the Mariner's Quadrants, Mariner's*

¹³⁹ Croucher, John S. and Rosalind F. Croucher. 2011. "Mrs. Janet Taylor's 'Mariner's Calculator': Assessment and Reassessment. *The British Journal for the History of Science* 44 no. 4: 493-507. 505.

¹⁴⁰ Croucher, John S. and Rosalind F. Croucher. "Mrs. Janet Taylor's 'Mariner's Calculator': Assessment and Reassessment. 505.

Astrolabes, Cross-staffs, Backstaffs, Octants, Sextants, Quintants, Reflecting Circles and Artificial Horizons in the National Maritime Museum, Greenwich (2009). This book serves two purposes; it provides an overview of the history of celestial navigation and catalogues almost three hundred and fifty nautical and navigational instruments contained within Greenwich's National Maritime Museum. While Bruyns and Dunn catalogue three of Janet Taylor's nautical instruments, they only devote one sentence to her in the first section of their book, which focuses on the history of instrument making in both Europe and North America throughout the nineteenth century. When discussing the best known sextant developers in London during the mid-nineteenth century, the authors briefly note that during the same period "other London firms emerged, such as that of Elliott Brothers and that of Mrs Janet Taylor, who exhibited navigational instruments at the Great Exhibition of 1851".¹⁴¹

Regardless of the disputed success of her mariner's compass, Taylor was still ahead of her time, undisputedly a talented and notable instrument maker in Victorian navigation. In addition to the mariner's compass, her passion project, she would adjust a multitude of navigational instruments: compasses, sextants, quadrants, and binnacles serve as just a few examples. She would also invent other instruments that, while not as innovative to the field, were still well-received by the maritime community and utilized aboard ships. Taylor would also work in compass adjusting; she would work closely with Beaufort's successor in the Hydrographic Office, John Washington, and provide several compasses to the Admiralty throughout the last few decades of her life. Her work would leave such a mark on the maritime community throughout her career that nautical publications such as the *Liverpool Mail* would ask the

¹⁴¹ Bruyns, W.F.J. Mörzer & Richard Dunn. 2009. *Sextants at Greenwich: A Catalogue of the Mariner's Quadrants, Mariner's Astrolabes, Cross-staffs, Backstaffs, Octants, Sextants, Quintants, Reflecting Circles and Artificial Horizons in the National Maritime Museum, Greenwich*. Oxford: Oxford University Press. 323 pp. 63.

question “What acknowledgement has been made to her by our government?”.¹⁴² This question was posed by the *Liverpool Mail* in 1837, shortly after the third edition of Taylor’s *The Principles of Navigation Simplified* was published, and also shortly after she was awarded a medal by the King of Holland for this book. It would take two decades for this question to be answered, when in January of 1860, Janet Taylor finally receives an annual pension from the Admiralty; £50.

¹⁴² Croucher, Rosalind F. and John S. Croucher. "Mrs Janet Taylor and the Civil List Pension-a Claim to Recognition by Her Country." *Women's History Review* 21, no. 2 (2012): 253-280.

Conclusion

Janet Taylor's accomplishments are wide ranging, but her work was contained to the field of navigation and maritime practices. Her mathematical genius, combined with her writing abilities and role as an educator in maritime London allowed her to navigate the patriarchal structure of the society in which she lived. Few women were able to do what Taylor did, move fluidly between the public and private spheres existent in the Victorian era. Considering Taylor's ability to utilize her talents and create business opportunities for herself, and the industrializing nature of an expanding Great Britain, there are many avenues for further research when contextualizing Taylor within her own world.

For historians in navigational and maritime histories, a narrative such as Taylor's complicates the idea of experience being gained through the time spent physically aboard ships at sea. The ways in which mariners were gaining experience and moving through the ranks was beginning to change as education reform seeped into every Victorian industry. With these reforms came examinations and classes from the Admiralty that needed to be taken in order to advance, and Taylor was able to facilitate part of this transition. Without being physically aboard a vessel, Taylor was able to teach mariners complex subjects and concepts that made their voyages safer and their calculations simpler and more precise. Widely celebrated Admiralty and Navy members are highlighted in maritime histories of the nineteenth century, but historians have an opportunity to expand on the perspectives present during this period, to reveal the heavy influence of behind-the-scene teachers like Taylor. While this is made more difficult by the fact that Taylor did not leave many personal records of her own, the discourse she left with astronomers and Admiralty members provides a good start.

Sir George Biddell Airy, Astronomer Royal and associate to the Admiralty, serves as a good example of how Taylor created a reputation for herself and conveyed her expertise through only paper and pen. Airy was skeptical of Taylor's work upon her first letter to him in the early 1850's, which espoused the success of using his calculations in her own experiments. By 1854, this image of Taylor in Airy's mind would change drastically after a detailed letter correspondence in which Taylor explained how she had conducted hundreds of experiments with ships on the Thames, and how each of these experiments had supported principles developed by Airy but deemed controversial by many common mariners (who were often inclined to stick to their tried-and-true methods of navigation). One of the last letters of this conversation, from Taylor to Airy, concretely proved to Airy the credibility and influence of the woman who independently ran a nautical academy in the Minories, the maritime hub of Victorian London.

The Crouchers, in *Mistress of Science*, provide the 1854 letter that persuaded Airy of Taylor's knowledge and talent. There are several sections of this letter (a couple pages in length) where Taylor conveys her expertise that would have impressed Airy. The first appears at the very beginning of the letter, in which Taylor reveals the scope of her experiments, and their fantastic success:

Since my last communication with you on this subject (I think 1846) we have had some hundreds of iron vessels of all sizes through our hands. We have swung them and adjusted their compasses according to the valuable directions you then gave me, and *we have not had one failure*, and I can name amongst the entire fleet nearly all the largest steam ships and sailing vessels which have left the Thames.¹⁴³

¹⁴³ Croucher, John S. and Rosalind F. Croucher. 2016. *Mistress of Science: The Story of the Remarkable Janet Taylor, Pioneer of Sea Navigation* Amberley Publishing. 203.

There are several parts of this letter introduction that would have caught Airy's eye, and interest. The first is the fact that Taylor's experiments have included "hundred of iron vessels of all sizes", proving two things; the fact that a large number of mariners have entrusted their ships to Taylor's temporary possession, and that she has proved her principles using a variety of vessels. She then shows her support of his work, having claimed to use it to conduct her own experiments. Having used his principles and finding her well-conducted experiments so successful, Airy would have no choice but to take Taylor seriously. To further establish herself as a notable name in the maritime community, Taylor would end this letter with a friendly reminder that it was her firm that had "adjusted all the large Iron Steamers that made the first voyages Round the World, and to India and back- no fault was found with the compasses and Captain Hyde of the 'Argo' expressed himself much satisfied with their working both out and home".¹⁴⁴ These letters are representative of many conversations between Taylor and other notable names within the maritime community of Victorian England.

Women's history also has potential as a future methodology in examining Taylor's movement between the public and private spheres, and the patriarchal structure at large, of the world in which she lived. As England began to expand, in industry, commercialization, and imperial or military conquest, opportunities were created in which gender was deemed less important than technological advancements and inventions that could aid the nation in its growth.

¹⁴⁴ Croucher, John S. and Rosalind F. Croucher. 2016. *Mistress of Science*. 205.

Taylor was able to use this environment to her advantage, creating careers that required her extensive knowledge and mathematical talent. She turned her talents into business opportunities, turned those opportunities into lifelong careers, and gained the respect of the people and organizations most important to her field; Victorian maritime practices. Developing a career as a woman author was hard enough during the Victorian period, let alone establishing oneself as a female educator (in charge of one's own establishment), or instrument maker of all things maritime; topics that were considered to be discussed or written about by a predominantly male demographic. However, Taylor was able to navigate these gender-based restrictions and not only create nautical tools or write a plethora of books on a myriad of subjects related to maritime and navigational practices, but make all of this digestible for the common mariner as long as they attended one of her two nautical academies.

While Taylor was given a considerable amount of recognition for her work throughout her life, following her death, and even today, her recognition is often undermined by comparing her to other notable women in nineteenth century astronomy. The woman she is most often compared to is Mary Somerville. Somerville, who lived and worked in Scotland during the same time as Taylor in London. Somerville's fields of expertise coincided with Taylor's, including mathematics, astronomy, education, and writing, but whereas Taylor would apply her skills to maritime and navigational principles, Somerville confined her experiments and publications to astronomy and, occasionally, magnetism. Also like Taylor, Somerville would establish herself using her career as an author, but this career would not last nearly as long. According to historian

Mary Bruck, “her two brilliantly successful books, *Mechanism of the Heavens* and *The Connexion of the Physical Sciences*, and the essay on comets, all published between 1831-1835, represent Mary Somerville’s short but intensely productive period”.¹⁴⁵ These works would establish Somerville as an astronomer; she would be one of the first two women to be inducted into the Royal Astronomical Society in 1835. Both women would receive considerable praise for their works and would use their roles as educators to influence the society in which they lived.

Today, works such as Mary Bruck’s *Women in Early British and Irish Astronomy* (2009) and Marilyn Bailey Ogilvie and Joy Dorothy Harvey *The Biographical Dictionary of Women in Science: L-Z* (2000) lump these two women together as mathematicians and astronomers, occasionally as authors. But as influential as these women were in these fields, they must be given more justice historiographically; they must be distinguished from each other because they definitely pursued their career goals in individual and unique ways. Taylor differed significantly from Mary Somerville, for example, in her pursuit and success in becoming not only an author, but also a publisher and instrument inventor.

Historically, we celebrate men like John Hadley and John Campbell for their maritime breakthroughs; but there was one woman, Janet Taylor, whose role as an educator, author, and instrument maker had a major impact on both Victorian maritime practices and even navigation today. Taylor was an excellent mathematician that adjusted the calculations used to find locations at sea, by taking into account the spheroidal shape of the earth; until her work, these

¹⁴⁵ Bruck, Mary. 2009. *Women in Early British and Irish Astronomy: Stars and Satellites*. New York: Springer. 81.

mathematical principles had portrayed the earth as being perfectly spherical, creating an inevitable margin of error. Her mathematical genius, and her ability to write and educate in a way that made this math attainable to the common mariner, gained her substantial credibility among the most notorious maritime organizations to exist during the Victorian era. However, her influence has been largely disregarded by maritime historians. The innovative and influential contributions Janet Taylor made to Victorian navigation and maritime practices raises one central question: why has she not been given due credit?

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