Introduction: Coal, Steam and Ships

> These are not times in which Steam Navigation Companies, of all others, can find safety in concealment and mystery; too much agitation prevails among Shareholders, and it will be found that the interest of both Directors and Shareholders will best be consulted by candid publicity.
>
> The Railway Magazine *takes steamship lines to task for lack of openness (1843)*[1]

Writing a credible history of ocean steam navigation is a challenging enterprise. Central to the methodology of this book is the inspirational work of the late Thomas P. Hughes on the history of large technological systems. Hughes' own historical focus lay with electrical power generation and distribution.[2] But his approach was never intended to be restricted to a single field of study. Nor did it seek to impose a rigid deterministic framework on its subject matter. Indeed, a principal strength is its malleability, enabling it to be reshaped to capture the histories of different technologies in different periods.

Four features of the Hughesian methodology are especially relevant to unlocking the secrets of ocean steam navigation. First, Hughes' approach gives priority to human agents. Technological systems are human inventions, shaped by choices, values, contingencies and, not least, fallibility. Second, the methodology focuses on the interconnectedness of the diverse components (material and social) that constitute a complex system. Third, his analysis concerns large systems that occupy geographical space. Spatially located, they are invented, designed, shaped by, constructed and operated within contexts that are often at once material, moral, spiritual, political, social and/or economic. And fourth, he recognizes that the projectors and managers of large engineering systems seek to maximize order and minimize disorder through a deliberate strategy of attempting to control recalcitrant elements that threaten to disrupt or destroy the system. Maximum control, he infers, often means that the elements in question have been incorporated into the system. As we shall now see through illustrative examples drawn from the principal chapters in this book, all four

[1] *The Railway Magazine* (*RM*) (1843: 206) (Editor).
[2] Hughes (1983).

interrelated features provide an invaluable toolkit for understanding the history of ocean steamships in the early Victorian period.[3]

'Never Known or Thought of in the Trial of the Steam-Engine': Human Agency at Work

'The men who worked out problems in diagrams and algebraics at home were not seen, and their names were never known or thought of in the trial of the steam-engine', the Glasgow clergyman Norman Macleod told 250 distinguished guests seated at lunch aboard the newest and largest Cunard mail steamer *Persia* in January 1856 (Chapter 15). 'So, perhaps, the names of ministers might never be thought of; but if they made the men who made the steam-engine, – if they made them more sober, more honest, more faithful, and more trustworthy, – then, perhaps, the clergy had more to do with that occasion than the world thought'. Amid the mutual congratulations, Rev Macleod's speech alone drew attention to the unnamed and unacknowledged engineers rather than simply to the leading projectors responsible for the ship.[4] In so doing, he highlighted the often forgotten but integral part played by the moral and spiritual capital of human agents in shaping a material system.

Rendering an individual human agent central to any narrative can readily slide into a story of a heroic entrepreneur, individual pioneer or inventor of genius. For example, Hyde's *Cunard* (1975) trades in 'forceful characters', chief among them Samuel Cunard who 'had the foresight of genius coupled with the gift of choosing men of ability as his associates'. Fox's *Ocean Railway* (2003) places Cunard centre stage: '[i]t was all there from the start', Fox declares. 'And at the centre of it all, driving and organizing, the elusive figure of Samuel Cunard and the great transatlantic line he founded'. In other accounts, it is the heroic, pioneering representation of Isambard Kingdom Brunel who overtakes Cunard in the narratives of pioneering geniuses. Conversely, Harcourt's *Flagships of Imperialism* (2006) retrospectively presents the Peninsula and Oriental Steam Navigation Company's (P&O) celebrated co-founder Arthur Anderson as 'crude and showy'.[5]

In *Heroes of Invention* (2007), Christine MacLeod offers a cultural history of the diverse ways in which engineers and inventors across industrializing Britain acquired heroic status. Once set in specific historical contexts, the making of a heroic genius can be seen to serve a variety of local and national agendas: civic pride, national identity and prestige, and the interests of a later

[3] Hughes (1987: 51–82); Hughes (1994: 100–13); Hughes (2004).
[4] *Liverpool Courier*, 16 January 1856; Smith (2014: 76); Shapin (1989, 1994: 355–407) (invisible technicians).
[5] Hyde (1975: 323); Fox (2003: xviii) (Cunard); Falkus (1990: 83–4) (Brunel's 'visionary engineering genius'); Harcourt (2006:160) (Anderson).

generation of engineers' intent on securing their professional standing, for example. James Watt or Brunel might have enjoyed comparatively little iconic status in their own lifetimes, but through the efforts of later generations of engineers they were transformed into national, as well as local, heroes through statues, portraits, biographies and all manner of civic commemorative events well reported in the press of the time.[6]

Heroes of Invention reminds us that heroic status is not intrinsic to a human agent but has to be constructed within social and other contexts. In the long run, ship-owners and shipbuilders as 'pioneering' or 'heroic' individuals have received a generous share of hagiographical literature, even if portraits were largely for in-house display and public statues were less common than in the railway world. At the beginning of ocean steam navigation, however, projectors had no guarantees of immortality, still less gifts of prophecy, but there was every prospect of ridicule or obscurity.

From the mid-1830s, for example, New England merchant Junius Smith aimed to raise upwards of 1 million pounds capital from London and New York investors to launch a fleet of eight large steamers. Craving the accolade of being the first projector of a transatlantic steam shipping line, he imagined himself receiving a knighthood from Queen Victoria. To that end he chose the name *Victoria* (later renamed *British Queen* while on the stocks) for his first vessel. But as engineering and financial problems mounted, the grand ambition foundered amid mistrust and tragedy (Chapters 4 and 6).[7]

The Royal Mail Steam Packet Company (RMSP) projector James McQueen also had mighty ambitions. With a track record in journalism, geography and Caribbean trade, this lowland Scot made it his goal to persuade metropolitan bankers and merchants to launch a large-scale mail steamship system. Awarded a state contract initially worth £240,000 per annum, the line lost ships and money. Directors identified McQueen as the scapegoat. Because of his supposed miscalculations of construction costs, coal consumption and route schedules and for his open authorship of press articles exposing the shortcomings of the line, he was erased from the Company's collective memory (Chapters 7 and 8). A century on, he had been redeemed as a heroic founder for the purposes of the Company's centenary history, especially in the wake of the financial scandal centred on its recent chairman Lord Kylsant.[8]

While wary of elevating its projectors as individual heroes, steamship companies took self-fashioning and public image very seriously. Following the Honourable East India Company (EIC) practice, both P&O and RMSP often used the term 'Court' to refer to their Boards of Directors. The Court

[6] MacLeod (2007: esp. 1–26).
[7] Pond (1927: 186–8) (knighthood), 266–79 (death).
[8] Green and Moss (1982: 141–3).

expected due deference from its officials, servants and proprietors. In the case of RMSP, Scottish landed gentlemen with close ties to northern British aristocrats initially dominated the Court. Attacks from the radical *RM* generated hostile reactions from company directors in both the RMSP and P&O. Company reputations were vulnerable to press exposés. Shareholders became restless, the more so if the competence of captains or officials was called into question. And once confidence began to retreat, investors took fright, share values declined, insurance on ships became more expensive, passenger numbers fell and changes of Government could threaten an inquiry into mail contracts and raise the possibility of their non-renewal (Chapters 8–10, 13).

A Company Secretary or managing director (MD) often wielded autocratic power both inside and outside a large steamship company. Particularly in cases where a Court of Directors remained aloof from day-to-day affairs, the MD acted rather like a courtier who knew his place but in practice exercised much authority. He not only managed the practical running of the business, but also protected confidential information regarding matters both of finance and discipline. Wayward masters and officers too had reason to fear him. For almost fifteen years, for example, Captain Edward Chappell, RN, managed RMSP's troubled system of ocean mail steamers. 'No complaint can reach the aristocratic board of the Royal Mail Company, but through Captain Chappell', a detractor observed in the *RM*. 'The noble lords, the directors, are as difficult of approach as his Celestial Majesty' (Chapters 8–10). Yet in the annals of the Company, Chappell's name is barely acknowledged.[9]

The Pacific Steam Navigation Company (PSNC) MD William Just used all his diplomatic skills to carry through a fraught transition from simple to compound engines in co-operation with Glasgow engine makers Randolph, Elder and Company. Serving in the post as guardian of confidence in the line for thirty years, Just saw PSNC expand from a mere two steamers to the largest steam navigation company in the world (Chapters 17 and 19).[10]

The historians of P&O have generally ignored James Allan in favour of the Company's public figures such as Anderson or Thomas Sutherland. Allan began his shipping career as a clerk in the Irish office of Richard Bourne's Dublin & London Steam Packet Company. When Bourne sold out to a rival, Allan transferred to the London office of the then Peninsular Steam Navigation Company (trading to the Iberian Peninsula) while still in his mid-twenties (Chapter 12).[11] First as secretary, then as Assistant Manager from 1847 and finally as one of the key MDs from the early 1850s, this most trusted of servants was with the P&O Company almost to the day of his death in September 1874

[9] Bushell (1939: 110).
[10] Wardle (1940: 73, 93, 132, 149).
[11] Harcourt (2006: 38).

(Chapters 14 and 18). Allan's only character flaw, in the verdict of merchant shipping historian William Schaw Lindsay, 'consisted in believing all other men to be as upright as himself'.[12]

In our period, character (rather than qualification) was often regarded as the 'stock in trade' of an individual who occupied a position of skill but was not necessarily a person of gentrified or aristocratic pedigree. This attribution was especially the case for engineers in general and for marine engineers in particular.[13] The RMSP's engineering superintendent, George Mills, carried heavy responsibilities that covered both the construction of new steamers and the maintenance and repair of vessels in the mail service. At a fraught meeting of directors and proprietors in 1854, shareholders expressed their concerns over weak financial returns, the poor performance of many of the newer steamers and the public perceptions of a company prone to physical and financial shipwreck. Several voices found the perfect scapegoat in Mills. But in appointing Mills to such a pivotal position, the directors' own wisdom and judgement was effectively under attack. They therefore rallied to the defence of Mills' character (Chapter 10).

David Elder, on the other hand, sustained his stock in trade as a trustworthy engineer throughout his life. '[H]e sought no public fame, and it is doubtful whether one in a hundred of those who, in all parts of the world, have seen and admired his works have ever heard of David Elder', *Engineering*'s anonymous obituary stated in 1866. Elder's works were indeed many. Over a period of four decades, this unassuming works manager for Robert Napier had overseen the design and construction, in every practical detail, of the side-lever marine engines that powered many of the Clyde-built river boats, coastal and cross-channel steamers and Cunard mail steamers for which the firm was soon famous. Omitted from the press reports of the *Persia*'s trial trip (Figure 0.1), Elder was the prime example of Revd Macleod's unseen and unnamed engineers who, self-taught and with no privileged family pedigree, played crucial roles in realizing the promises of the projectors of ocean steam navigation (Chapter 2).[14]

'How Beautiful a Machine is this Magnificent Ship'!: The Steamship as System

When the Revd Macleod crossed the Atlantic in 1845 aboard the first-generation Cunard mail steamer *Acadia*, he stood in awe of the steam engines that David

[12] Lindsay (1874–6: vol. 4, 379–81n).
[13] Marsden and Smith (2005: 8) (Babbage on character and confidence). I thank Ben Marsden for this insight.
[14] Smith (2014: 80–4) (Elder's engineering practices).

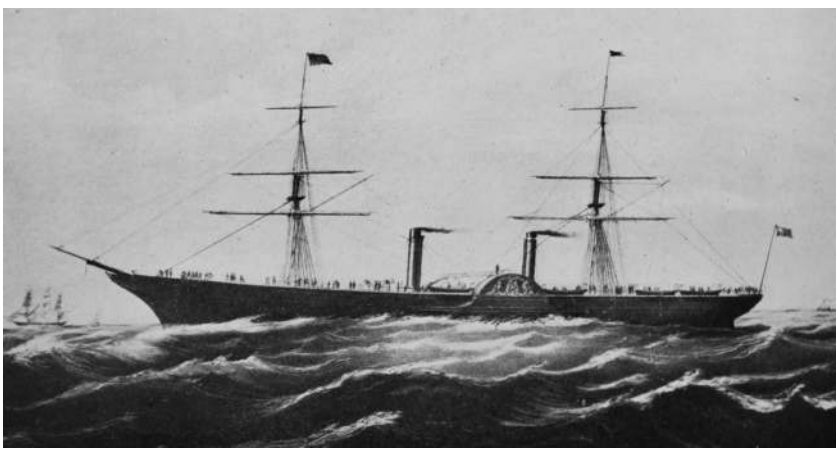

Figure 0.1. Cunard's crack iron paddle steamer *Persia* (1856) built by Robert Napier

Elder had designed. 'What a wonderful sight it is on a dark and stormy night to gaze down and see those great furnaces roaring and raging', he wrote. '… And then to see that majestic engine with its great shafts and polished rods moving so regularly night and day, and driving on this huge mass with irresistible force against the waves and storms of the Atlantic'. Macleod had here witnessed for himself the very interconnectedness of furnaces, boilers, side-lever engines, crank shaft, paddlewheels and hull, all working together to produce regularity in crossing the hostile ocean. But neither did he ignore the integral role of the humble human actors in the guise of the firemen 'laughing and joking' as they fed coal into the hungry furnaces. And when he reflected on the human engine-builder's intellect and skill, he saw a pointer to God: '[i]f the work glorifies the intellect of the human workman, what a work is man himself'![15]

In a less definite, yet compatible vein, the author of RMSP's official *Guide to the Madeiras* (1844) recognized the god-like qualities of the human designer of the steamship: '[h]ow beautiful a machine is this magnificent ship, and how like a god is man who can create such a machine, so complete, so perfectly applicable to his purposes'! A good steamship was a well-designed machine, an engineering system whose constituents parts – hull, masts and sails, engines, boilers, furnaces, steering, accommodation, master, officers and deck and engine-room crew – formed part of a single, orderly entity. Take away, alter or damage any of these constituents and the vessel risked losing that wholeness.[16]

[15] Macleod (1876: vol. 1, 238); Marsden and Smith (2005: 249). Contrast Burgess (2016: 25, 39) (steamships entailing a disconnection from religious belief).
[16] Osborne (1844: 12–13). I thank Stephen Courtney for this reference.

Steamships, however, were not the only machines of the ocean in which every component functioned as part of an integrated whole. Through a gale, wrote author and former master mariner Joseph Conrad from the vantage point of 1906, 'the silent machinery of a sailing ship would catch not only the power, but the wild and exulting voice of the world's soul …'. In contrast to steam, the machinery of a vessel under sail does 'its work in perfect silence and with a motionless grace, that seems to hide a capricious and not always governable power, taking nothing away from the material stores of the earth'. Conrad also spoke for many fellow-seafarers in his late novel *The Rescue* (1920), begun in the 1890s and set in the eastern seas of the 1860s, when he describes Captain Lingard's view of his brig: '[t]o him she was as full of life as the great world … She – the craft – had all the qualities of a living thing: speed, obedience, trustworthiness, endurance, beauty, the capacity to do and to suffer – all but life'.[17]

Changes to hull-, mast- and engine-systems could radically alter a ship's performance. The character and consequences of such changes were often contested. Screw propulsion, for example, was not self-evidently superior to paddlewheels, the celebrated *Rattler* demonstrations notwithstanding (Chapter 14).[18] Contemporary reports of Brunel's *Great Britain* in her original role on the Atlantic often centred not on the benefits, but on the fragility of the screw. Passengers tended to praise her qualities as a sailing vessel, qualities made all the more noteworthy by the frequency with which the propeller lost blades and ceased to function for the remaining duration of the voyage (Chapter 6).

With passenger requirements integral to the design and operation of an ocean mail steamship, voyagers often complained of the discomforts of screw vessels. Having survived a January crossing to Boston aboard Cunard's first paddle-steamer *Britannia* in 1842 (Chapter 5), Charles Dickens returned to the United States in 1867 on the same line's much larger iron screw steamer *Cuba*. 'These screws are tremendous ships for carrying on, and for rolling, and their vibration is rather distressing', he told his son. Writing to his dentist a couple of months later, he recounted how divine service had taken place 'with a heavy sea on'. Two big stewards attempted to bring the officiating minister to the reading desk but were thwarted by the ship's rolling and pitching. As a result, the 'extremely modest' reverend gentleman had to embrace 'with both arms as if it were his wife' the mast in the middle of the saloon. And all the while, Dickens observed with a tone of delighted irony concerning the line's policy of insisting on Church of England services (Chapter 15), 'the congregation were breaking up into sects and sliding away'.[19]

[17] Conrad (1906: 38); Conrad (1950: 20–1).
[18] Lambert (1999: 40–52) (*Rattler* trials).
[19] Storey (1999–2002: vol. 11, 494–5; vol. 12, 24–5).

The large iron screw steamers of P&O were similarly prone to rolling in ocean waves and also exhibited steering problems in confined waters (Chapter 14). Reverend Macleod took passage to India on the *Rangoon* in 1867. One Sunday on the Red Sea he stood preaching for nearly an hour on the rolling deck, and became so exhausted with the heat and exertion that 'Old Indians ministered to me, and poured iced water over my head, and gave me some to drink with a little brandy in it, which quite restored me'.[20] The sources do not record how the assembled company received the brandy-assisted sermon.

Satirically minded passengers could view the ocean steamer as a self-contained system isolated from a wider humanity. A return passage from England to New York on the *Great Western* inspired Judge Haliburton to write some twenty-eight satirical letters, each under a different persona, including 'From the Professor of Steam and Astronomy (otherwise called the clerk) to the [GWSS] Directors'. At the end of this *Letter-Bag of the Great Western*, Haliburton vividly captured the notion of a passenger steamer as a self-contained microcosm that reflected the life and lives of the larger world. 'One hundred and ten passengers, taken indiscriminately from the mass of their fellow beings, are a fair "average sample" of their species', he affirmed. '[T]he vessel that carries them is a little world, and life in a steamer is a good sample of life in "the great world"'. Thus there are 'the same complaints, the same restlessness, and the same air of perverse dissatisfaction in their letters, as we meet with on land'. It was, he claimed, 'the power of steam' that was at work both in the Atlantic crossing and in life: 'although the scene is varied by calms, fair breezes, and storms, still the great machine is in continual progress'.[21]

'The Railway Train *Minus* the Longitudinal Pair of Metal Rails': Systems of Ocean Steam Navigation

'We have been able to traverse wild regions that were previously almost impenetrable, and to bear the fruits of civilization to parts of the globe where they would otherwise have remained unknown for many years to come', French engineer–economist Sadi Carnot observed of steam-powered vessels in 1824. 'There is a sense in which steam navigation brings the most widely separated nations closer together'. On the arrival of the first Cunard mail steamer in Boston sixteen years later, the Unitarian Revd Gannett shared Carnot's optimistic Enlightenment vision. 'This great and wide sea', he told his congregation, '… at first sight appears to be a barrier … to the intercourse of the nations who live on opposite shores'. But the arrival of the *Britannia* showed that God

[20] Macleod (1876: vol. 2, 261–2).
[21] [Haliburton] (1840: 184–5). Burgess (2016: 147–9, 249) discusses ships as self-contained worlds in relation to social class in the later nineteenth century.

intended the ocean 'to be the highway of the nations, on which they might pass and repass and never crowd its ample space'.[22]

In the late 1830s Scottish journalist and geographer James McQueen constructed a 'General Plan' to initiate, throughout the western and eastern oceans of the world, lines of mail steamers which he termed 'mail coaches of the ocean' (Chapter 7). In contrast to McQueen's imagery, Cunard told friends of his belief that 'steamers, over a route of thousands of miles in length, might start and arrive at their destination with a punctuality not differing greatly from that of railway trains'. In order to achieve this result, 'the ships should be thoroughly built and thoroughly well manned, and their course laid down with the greatest accuracy'. The analogy required the steamship 'to be the railway train *minus* the longitudinal pair of metal rails'. Half in jest, however, he suggested that such rails were required only on 'ugly, uneven land' but not on the 'beautiful level sea'.[23]

While the authenticity of Cunard's verbal remarks cannot be verified, they are consistent with contemporary assumptions that steamship systems would deliver that regularity and punctuality that sailing packets did not. Mail lines were perennially concerned to protect their reputation and finances by maintaining punctuality, often at high cost. '[T]he matter of punctuality', the chairman told RMSP shareholders in 1868 with respect to persuading the Government to renew its large mail contract, '… is only attained at a very enormous outlay [on fuel], and to secure it forms the most considerable charge upon our Government subsidy'. Higher speeds in such cases were dictated by state demands for faster communication and greater punctuality, rather than simply by public demands for more rapid passages or by company desires to show off their latest steamers.[24]

Quite a few of the men involved with steamship affairs had been weaned on railway engineering and finance. Most often cited is Brunel's representation of the GWSS project as a maritime extension to New York of the Great Western Railway (GWR) between London and Bristol.[25] Junius Smith obtained the services of Isaac Solly as first chairman of his Atlantic steamship company. Solly's chairmanship of the Great Birmingham and London Railway Company gave him valuable credibility, not least because railway companies were especially adept at raising large amounts of capital for their joint-stock projects (Chapter 3). Dionysius Lardner's knowledge of railway engineering almost certainly prompted him to introduce the term 'locomotive duty' (the number of miles one ton of coal per horsepower took a locomotive or steamship) into his

[22] Carnot (1986: 62); Gannett (1840: 7–8).
[23] Hodder (1890: 193–4).
[24] RMSP GM (28 October 1868: 12). Compare Burgess (2016: 23–5) (speed).
[25] Griffiths et al. (1999: 15); Buchanan (2002: 57); Fox (2003: 70). Fox's *The Ocean Railway* has little to say on the analogy. For insightful perspectives on railway experiences see Schivelbusch (1986: esp. 1–15).

evaluation of the prospects for viable Atlantic steam navigation (Chapter 3). Henry Booth, promoter of the Liverpool and Manchester Railway (L&MR), contributed a rigorous paper on steamship design to the Liverpool Polytechnic Society in the mid-1840s.[26] And Alfred Holt acquired his engineering skills on the same celebrated railway (Chapter 17).

The validity of an analogy between steamship and railway systems became a hotly contested topic at RMSP's general meetings (GMs) in the mid-1850s. A proprietor, among many such shareholders with interests in railways, put the question '[w]hy should this Company be dealt with differently from a Railway Company'? The acting chairman, Captain Shepherd of the EIC, vigorously asserted that 'there is the greatest possible contrast between a Railway and a fleet of ships under [mail] contract for a service of five or six years only'. A railway company with its line already constructed has 'under ordinary circumstances a monopoly of that line in perpetuity'. It could, for instance, calculate the traffic, apportion its expenditure to its receipts and estimate what its district was likely to require were the population to go on increasing. Then if 'things go on well they know that they will be justified in calculating upon a continuous and a profitable trade'. It was, he declared, not so with RMSP. The shipping company more nearly resembled 'a party who had the lease of a line for six years'. Its 'magnificent property' of mail steamers was therefore at best akin to 'the whole of the rolling stock sufficient to perform the service of the line for that period but which may afterwards be thrown upon your [the proprietors'] hands and become comparatively valueless'. Mail steamship company tracks remained little more than lines on Admiralty charts.[27]

The large-scale geographical system of the RMSP had been premised on a fleet of identical mail steamers in order to ensure regularity of operation. In the ideal system, the dozen or more mail steamers would be found at definite intervals from one another along the tracks they followed. Changing any one of these steamers for one of a different size and power changed the system. The two main building programmes, completed in 1842 and in 1852 to coincide with each new mail contract, consisted respectively of classes of fourteen and five vessels. Replacing these fleets or even updating in terms of size and speed was thus an extremely expensive business (around £500,000 in the second programme). And as the Chairman told the proprietors in 1856, 'the ship built in 1852 upon the most approved plan and fitted with all the improvements in her Engines and Machinery known to Science, may be altogether superseded by the vessel built in 1853 or 1854'.[28]

As part of increasingly complex systems, railway companies possessed locomotives, rolling stock, stations, maintenance depots and even hotels. Steamship

[26] Booth (1844–6: 24–31); Marsden and Smith (2005: 100–1).
[27] RMSP GM (10 April 1856:13–16).
[28] RMSP GM (10 April 1856: 16–17).