Surprisingly, Britain was not always a maritime nation.

Before the sixteenth century, English merchants might hop across the channel to Calais or Antwerp, or else hug the coastline down to Bordeaux or Spain. A handful might venture a little further, or up to Iceland, but few, if any, had experience of sailing the open ocean. Even trade across the North Sea or to the Baltic was largely unknown – it was dominated by the German merchants of the Hanseatic League.

The seas for England were a traditional highway for invaders, not a defensive moat. England shared an often hostile land border with Scotland, until James VI of Scotland became de facto heir to England in the 1580s and 90s. And it shared a land border with France until 1558, around the major trading port of Calais. Both of these borders required expensive fortifications, garrisons, and land forces, rather than a navy. England before the sixteenth century had no navy really to speak of, not just administratively but physically in terms of the simple lack of ships.

It may have been an island nation, but its later reputation for seafaring was not automatic. It was not the natural result of its geography. Becoming a maritime nation was instead a strategic choice.

That strategic choice took investment in skills, in innovation – even innovating about how to innovate – and investment in carbonisation (as opposed to the de-carbonisation of today.)

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It's a little-known fact that the UK's first, modern-style patent monopoly for an invention was that given in 1496 to the Venetian explorer Zuan Chabotto (aka John Cabot) and his sons. Granted by Henry VII, the patent gave them a monopoly over the trade and products of any lands that they were to discover – a legal procedure unlike anything that earlier English explorers had attempted, and differing from what Spanish or Portuguese explorers had done before. Cabot's patent adapted the patents for inventions that had been pioneered in Venice, and while it may now on the face of it seem surprising to see it adapted to discoveries, back then the concepts of invention and discovery were almost indistinguishable.

Columbus, for example, used the Latin word invenio – "to find out" – when announcing his discovery of the new world. And Francis Bacon talked of the discovery of the Americas and the invention of the magnetic compass in the very same sentence by using the word inventio for both. Cabot's 1496 patent was, in Latin, ad inveniendum, discooperiendum, et investigandum, translated in the mid-sixteenth century into English as "to seek out, discover, and find".

Cabot and his sons did manage to find the fittingly-named Newfoundland. But there was little further progress until the 1550s thanks to Cabot's son, Sebastian Cabot, who in the meantime had become pilot-major for the entire Spanish Empire – the head of training for all its navigators. In his seventies, Sebastian Cabot returned to England and taught an entire generation of English navigators how to venture further away from the coasts and, like the Iberians, look to the stars.

The traditional, coast-hugging method had been to learn to recognise particular landmarks or use a lead and line – just a thin rope weighted with some lead – to determine their location from the depth of the water. Cover the lead with some kind of gum, and they could bring up some sediment from the sea floor to double-check. A pilot would learn the kinds of sand and pebbles to expect from different areas. When they risked travelling out to sea, away from the coastline, they used a basic system of dead reckoning, taking their compass bearings from a known location, estimating their speed, and keeping in a particular direction for long enough. Or at least hoping to.

The Iberian method that Cabot introduced them to, of celestial navigation, was to measure the altitude of heavenly bodies and then use geometry to determine one's latitude. Although many of us have heard of John Harrison and his quest to solve longitude in the eighteenth century, two hundred years earlier the English were still struggling with latitude. It demanded mathematical skill and unfamiliar instruments.

And Cabot brought his 1496 patent back into play, making it the basis of the world's first ever joint-stock corporation. As it had been issued to his father and his brothers for life, Sebastian Cabot got it re-confirmed and used it to attract investors. After all, investment was necessary for such hugely expensive, risky ventures, and it was better to draw upon the wealth of many wealthy merchants rather than having to appeal to just a cash-strapped monarch.

Cabot's corporation called itself the "Mystery and Company of the Merchant Adventurers for the Discovery of Regions, Dominions, Islands and Places Unknown", and with his training its ships went off in search of a north-east passage to China and Japan. They didn't find it, given the ice, but they did manage to discover the White Sea and the northern coastline of Russia. The company came to be known as the Muscovy Company.

Thus, thanks to Cabot's training in the 1550s, English ships soon started venturing further, into the White Sea, the Baltic, the Mediterranean, down the coast of Africa, around the Cape of Good Hope into the Indian Ocean, across the Atlantic, and beyond. By the 1570s an English ship under Francis Drake even managed to circumnavigate the entire globe.

On the early experimental venture to the Mediterranean was a young man named Matthew Baker – now an almost unknown name, but who by 1600 was known as one of the country's greatest inventors. Just as geometry transformed England's navigation, it also allowed Baker to transform ship design.

Traditionally, the master shipwright had to design “carvel”, smooth hulls using full-sized templates, or frames, which were placed along the keel to determine the width and height of the hull, like cross-sections up and down the length of the ship. To the edges of these frames were then fixed ribbands – long, pliable boards running down the ship’s length. Altogether, the frames and ribbands formed a temporary, basket-like structure, to guide the moulding of the ship’s permanent hull around it.

After the placement of the first few, which might be pre-specified in size, the next ones along were typically determined according to the curve of the ribbands. Calculation was certainly involved, but it took place in the form or marking and adjusting the wood itself. Design and construction both took place in the shipyard, and at full scale through the medium of wood.

What Matthew Baker did in the 1570s was to take the design process out of the shipyard, and onto paper. He drew his ships to scale. And by using pen and paper, with geometry to make such drawings possible, he opened up grand new possibilities for design. His process allowed him to cheaply conduct his own experiments and innovate, drawing out new designs for frames, using geometry to work out how any variation would affect the overall shape of the hull, as well as its weight and carrying capacity – all at the cost of only time, ink, and paper, and avoiding the huge potential waste of conducting experiments at full scale in wood.

Thanks to that revolution in how to design ships, better designs soon followed. It’s commonly thought that the Spanish Armada of 1588 was defeated thanks to a storm. But this was actually propaganda put out by the English, to make it seem like God was on their side – one of the reasons the English defeated the Armada was down to superior ship design.

The old ocean-going carracks and galleons, with their high forecastles and aftercastles, were suited to clearing an enemy’s decks with arrows and gunfire, as well as to defend against boarders. They were designed for combat at close quarters, in which height was an advantage. They were floating fortresses. Baker, however, designed much sleeker ships, elongating the hulls, lowering the forecastle and setting it further back, as well as flattening the aftercastle. By making the ship less top-heavy, they were considerably more manoeuvrable, and could have longer and lower gundecks, with more of the ship’s displacement devoted to cannon. Rather than killing an enemy ship’s sailors and soldiers, the race-built galleons were optimised for blasting through its hull. They used the broadside.

One naval historian has termed the change “The Dreadnought Revolution of Tudor England”, comparing it to the great leap forward in naval technology of the early 1900s. In fact, by complete coincidence, one of the very earliest race-built ships was also called the Dreadnought. History continues to repeat.

At the same time, English ships of all kinds increasingly focused on using domestically-produced iron guns, rather than bronze. Iron guns were in many ways worse for ships than those of bronze. They were heavier, prone to corrosion, and more likely to explode without warning. Bronze guns, by contrast, would first bulge and then split, but in any case tended to last. When the British captured Gorée off the coast of Senegal in 1758, they found a working English-made bronze cannon that dated from 1582. Yet iron was only 10-20% the price of bronze. Although the Royal Navy for decades continued to prefer bronze, cheap, medium-sized cannon of iron proliferated, becoming affordable to merchants, pirates, and privateers — a situation that was unique to England.

English ships were thus especially well-armed, allowing them to access new markets even when they sailed into hostile waters. They were soon some of the only merchants able to hold their own against the latest Mediterranean apex predator, whether it be the Spanish navy, Algeria-based corsairs, or Ottoman galleys. The English hold over the hostile markets was only threatened during times of peace on the continent, when their ships' defensiveness no longer gave them a special advantage. The Dutch usurped English dominance of the trade with Iberia and the Mediterranean, for example, during the Dutch Republic's truce with Spain 1609-21. Their more efficient ships, especially for bulk commodities — the fluyt invented at Hoorn in the late 1580s — were cheaper to build, required fewer sailors, and were easier to handle. But these advantages only made them competitive when the risk of attack was low, as they were hardly armed. When wars resumed, the English had a chance to regain their position.

Finally, I should mention the importance of access to hemp for cordage, naval supplies like pitch for caulking, and above all timber for building the ships themselves. Trying to ensure access to these materials was a major impetus for the colonisation of the chillier parts of the New World, like New England, which lacked the luxury exports of other areas, like Caribbean sugar. It was also why access to the Baltic, which supplies so many of these goods, became an overwhelming strategic necessity in British strategy. The Royal Navy attacked Copenhagen not just once, but twice, in 1801 and 1807, even though Britain and Denmark-Norway were officially at peace.

It was also because of the strategic importance of ensuring timber supplies that there was a concerted effort in England to convert as many industries as possible that burnt wood or charcoal, to instead burn coal and peat. A large proportion of early seventeenth-century patents were for introducing coal as an alternative fuel to brick-making, salt-boiling, glass-making, iron-making, bread-baking, and even heating people's homes. Conserving timber was a major challenge, especially as it took 80-120 years for an oak's timber to be ready for use in a ship. Building a ship required investments not just by the previous generation, but the ones before that, and before that.

And with the growth of coal in industry and heating – London made an extraordinarily rapid switch towards coal for heating over the course of 1570-1600 – the trade of coals from Newcastle and Sunderland down the English coast also became a major strategic concern from the point of view of skills. Along with the fishery, the coal or "colliery" trade became known as the "nursery fo sailors", where landlubbers could first find their sea legs before progressing to more challenging and longer-distance voyages.

These purposeful investments in becoming a maritime nation – in innovation, skills, and resources – had a dramatic effect. Having once relied on foreign merchants for most imports and exports, it was soon English navigators in English ships controlling the country's foreign trade (British after the union of 1707), and expanding it farther and farther afield. By trading directly, rather than through foreign merchants, there were large profits to be had. These profits led to the spectacular growth of London, from an unimportant city of just 50,000 in the early sixteenth century, to one of the largest metropolises in Europe of over 500,000 by 1700. And they made it a centre for the making of precise navigational instruments and related trades like clockmaking and watchmaking too. By 1700, thanks to the maritime industries, Britain was thus ready for the Industrial Revolution and the unprecedented economic growth that has continued to this day.

- Dr Anton Howes, Historian of Innovation