

THE INDUSTRIAL REVOLUTION

INVENTION AND INNOVATION



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Often thought of as beginning in Britain in the 18th century, the Industrial Revolution (c.1750-1850) is characterised by its many brilliant figures and innovations.

It was a time epitomised by the wide scale introduction of machinery, the transformation of cities and significant technological developments. Many modern mechanisms have their origins from this period.

From Josiah Wedgwood to William Morris, J.M.W Turner to Isambard Kingdom Brunel's *SS Great Western*, this eBook focuses on some of the remarkable inventions and inventors of this age.

Detailed articles explain key topics, edited from various History Hit resources. Included in this eBook are articles written for History Hit by authors such as Martin Easdown and Martyn Pring. Features written by History Hit staff past and present are also included.

You can access all these articles on historyhit.com.

The Industrial Revolution: Invention and Innovation was compiled by Tristan Hughes.

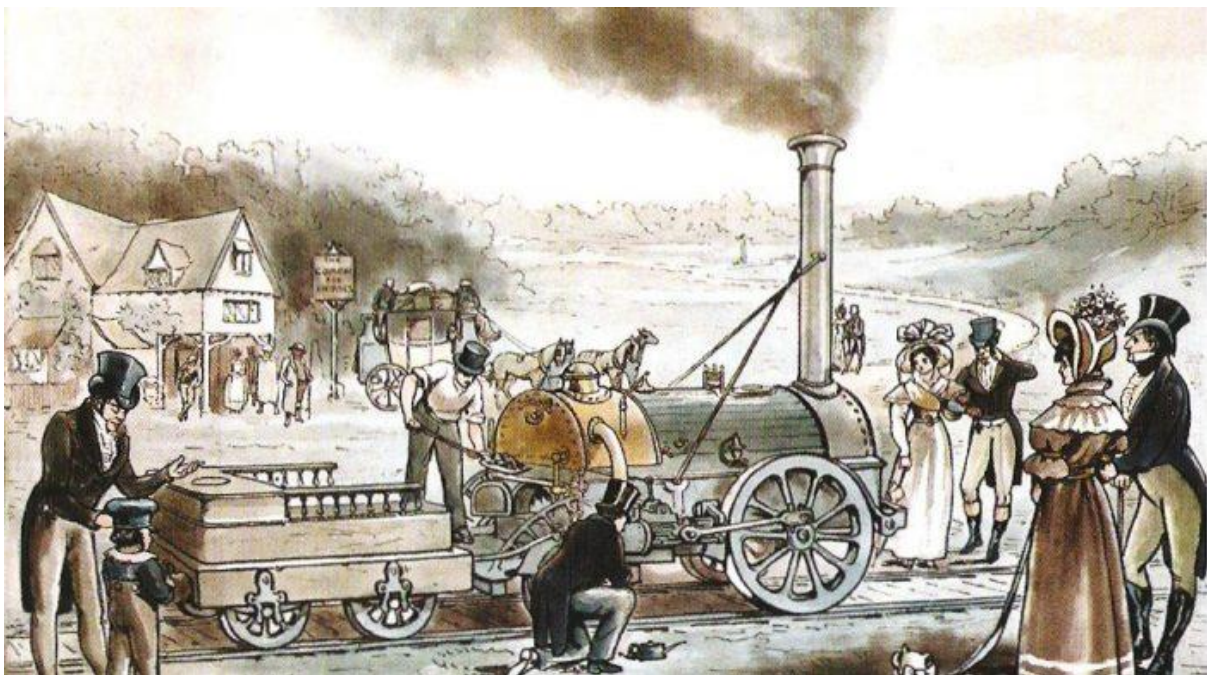


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HMS Warrior.

What Was The Industrial Revolution?

By Adam Dalrymple

The Industrial Revolution was a period of profound change between c.1750 and 1850, in which new inventions and manufacturing processes transformed the economy and wider society.

The Industrial Revolution began in Britain with the mechanisation of the textile industry, but would eventually transform almost every aspect of life from transport to agriculture. It changed where people lived, how they worked and what they bought.

In short, the Industrial Revolution created the modern world.

New inventions

At the heart of the Industrial Revolution were new inventions that fundamentally transformed the British economy.

One of these crucial inventions was the steam engine, introduced by Thomas Newcomen in 1712 to drain flooded coal-mines. Scottish inventor James Watt developed the design, devising an engine that would power industries hitherto dependent on wind and water for energy.

The textile industry was the first to experience the explosion of growth associated with the Industrial Revolution. Production was moved into factories and the mechanisation of cotton spinning increased the output of a worker by 500%. Britain became a major player in the world textile trade.

After that, new inventions reshaped many major industries. The invention of coke smelting revolutionised iron production; the production of new chemicals revolutionised textile bleaching; the new railway and canal network revolutionised how people travelled; and new tools like the milling machine revolutionised metalworking.

The economy transformed

Like every pre-modern economy before it, most of the people in Britain in 1600 worked in agriculture. One vital harbinger of the Industrial Revolution was the increase in agricultural productivity: between 1600 and 1800 it doubled in England.

This freed up people to work in other sectors, and as a result more and more people ended up working in industry.

The fuel that powered the Industrial Revolution was coal. The steam engine drained mines and enabled far more coal to be extracted, which in turn powered more engines.

When industries integrated new inventions and coal power into their manufacturing processes, economic growth skyrocketed.

Society transformed

Away from the factories, society transformed as well. The pace of population growth reached levels not matched in all of history before or afterwards. 6 million people lived in England and Wales in 1700. By 1801 it had doubled, and by 1850 the population was 16.8 million people.

This vastly larger population flooded into cities from the countryside. Between 1600 and 1800, the urban population in England increased from 8 to 28% of the population, whereas France's urban population increased from 9 to 11% during the same period.

London flourished, but many cities in the north of England like Manchester, Liverpool, Birmingham, Leeds and Sheffield were the ones to benefit most from the Industrial Revolution. Glasgow also enjoyed a meteoric rise to become known as the "Second City of the Empire".

They all grew from modest towns into imperious industrial cities.

A new middle class flourished and the working class found employment in industry. However, working conditions were abysmal. Factory employees worked long hours and got paid very little. Child labour was common.

Society changed drastically during the Industrial Revolution. Cities sprawled out in every direction and factories rose up out of them. Britain looked a very different country in 1750 than it did in 1850.

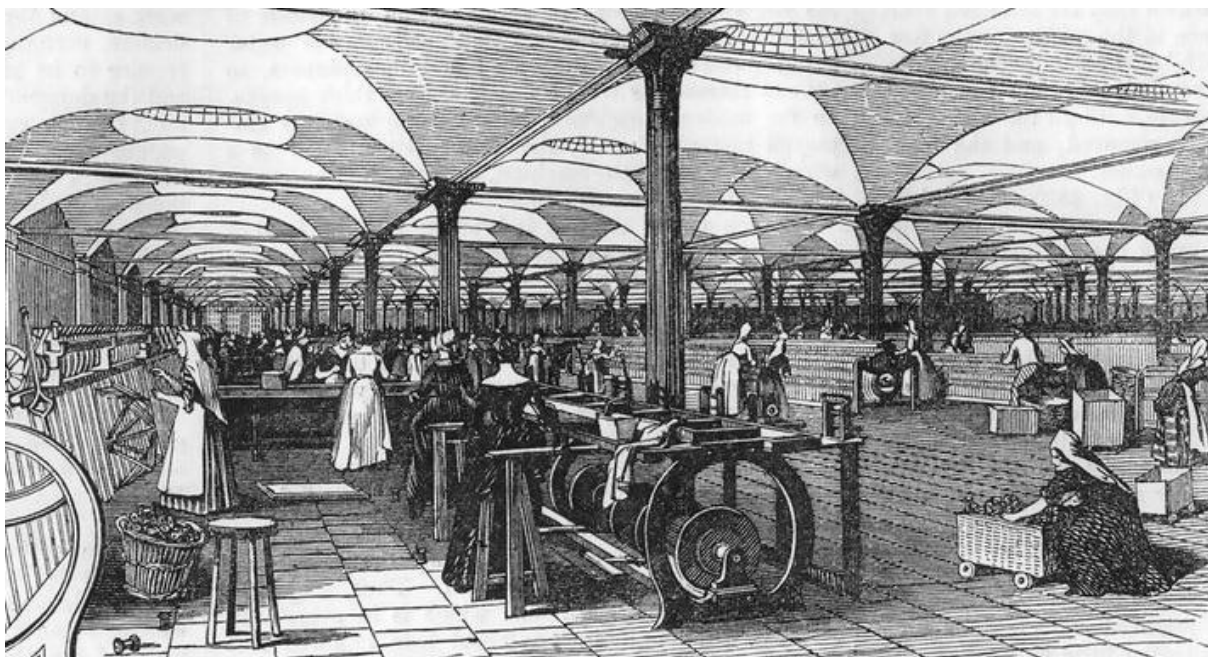
Why Britain?

This question is the subject of a great deal of historical debate. Hundreds of different factors have been suggested from the existence of secure property rights, to a culture of scientific discovery, to flourishing foreign trade.

While these are all probably true to some extent, they were also present in many other countries like France, the Dutch Republic and China.

It seems that cheap and abundant coal supplies and high wages might be what set Great Britain apart. They invented so many new machines because it was profitable to do so, while it may not have been so worthwhile in other places.

The Industrial Revolution spread out from Britain in the later 19th century to continental Europe, America and Japan. Technology developed in the British Isles made its way across the Channel and the Atlantic, and transformed the lives of people across the world.



How Did Josiah Wedgwood Become One of Britain's Greatest Entrepreneurs?

By Alice Loxton

Famed as the 'Father of English Potters', Josiah Wedgwood led English pottery from a cottage craft to a prestigious art form sustaining an international business.

He was a pioneer of modern marketing, a prominent abolitionist and the grandfather of Darwin. Here's the story of Wedgwood's remarkable success.

Experiment and innovation

Josiah Wedgwood was born in 1730 to a family of potters from Staffordshire. They were English Dissenters, and Josiah's grandfather was an active Unitarian minister. At the age of nine, Josiah's father died, which forced him to start working as a thrower, working with clay on a spinning disc. Soon he worked as an apprentice for his eldest brother, Thomas Wedgwood IV.

However, a vicious bout of smallpox left him with a seriously weakened right knee, proving almost impossible to work the foot pedal of a potter's wheel. After years of discomfort, he eventually had his leg amputated in 1768, at the age of 38. As a result, from an early age, he indulged in experimentation on the design and development of pottery.

His family business produced pottery which was inexpensive and poor quality, black and mottled. Josiah was determined to do better.

By 1750, there were about 130 potteries in North Staffordshire, mostly producing black and red glazed wares. Wedgwood's innovation came in transforming the clumsy earthenware body of pottery into an elegant product suitable for elite society. He must have felt a huge sense of achievement when he wrote in his experiment book, 'A Good wt. [white] Glaze'.

The exuberance and splendour of rococo and baroque had become distasteful, and the intricacies of chinoiserie seemed dated. Fashionable neo-classical tastes

demanded the purity and simplicity of antiquity – Wedgwood's white glaze fitted the bill perfectly.

He wrote to his brother in 1765,

'I have begun a course of experiments for a white body & glaze which promises well hitherto'.

In 1762, Josiah met Thomas Bentley, a Liverpool merchant who became a lifelong friend. Bentley's extensive travels in Europe acquiring knowledge of classical and Renaissance art would influence Wedgwood's designs and allow him to capture the neo-classical style.

His big break came later in 1765, when Queen Charlotte commissioned 'A complete sett of tea things' – including a dozen cups for coffee, six fruit baskets and stands, six melon preserve pots and six hand candlesticks.

Determined to make the most of this royal connection, he gained permission to style himself 'Potter to Her Majesty' and title this cream earthenware as 'Queen's Ware'.

Wedgwood's pieces became the height of fashion, with orders flying in from across the globe. Empress Catherine the Great of Russia requested a service of Queen's Ware, receiving 952 pieces in 1774.

Wedgwood's designs have retained a place in royal households ever since – they adorned the banqueting tables at Queen Elizabeth II's coronation in 1953, and a 1,282 piece dinner service was ordered by The White House during President Roosevelt's time in office.

Jasperware

Around 1771, Wedgwood began experimentation with Jasperware, a type pottery which had a 'biscuit' finish – matte and unglazed. The fired body of the vase was naturally white, but could be stained with metallic oxides – chromium oxide for sage green, cobalt oxide for blue, manganese oxide for lilac and the salt of antimony for yellow.

His pale blue was so popular it became known as 'Wedgwood Blue'.

Relief decorations were applied in contrasting colours, usually white. These reliefs were produced in moulds and applied as sprigs, which were low relief shapes made separately and applied to it before firing.

The design of these reliefs was inspired by classical art, popularised by recent excavations in Italy – Pompeii was rediscovered by a surveying engineer in 1748. However, contemporary tastes considered some naked figures 'too warm', and the sensuality of Greek gods too readily apparent. As always, Wedgwood was quick to respond to his customer demands, providing clothing or fig leaves to satisfy sensibilities.

The Portland Vase

One of the great inspirations for Wedgwood's work was the collection of Sir William Hamilton. Hamilton, whose wife was the mistress of Nelson, was British Ambassador to the Kingdom of Naples from 1764 to 1800. He became an important figure for British visitors in Italy, and housed an impressive collection of antiquities – including the Portland Vase, a Roman cameo glass vase.

Hamilton lent this vase to Wedgwood in 1784 after a fellow sculpture described it as

'the finest production of Art that has been brought to England and seems to be the very apex of perfection to which you are endeavouring'.

Wedgwood spent four years of painstaking trials attempting to duplicate the vase in black and white jasperware. His numerous attempts (on display at the V&A), suffered from cracking and blistering, and the sprigged reliefs peeled off during firing.

Finally, in 1790, the Portland Vase was recreated in Wedgwood's stoneware – perhaps his pièce de résistance. When it was exhibited in The British Museum later that year, the initial showing had 1,900 tickets, which sold out immediately.

The inventor of modern marketing

Wedgwood's innovation was not limited to the kiln – he is often credited as the inventor of modern marketing. Utilising the demands of the consumer revolution and

the growth of the middle classes, he invented a multitude of savvy sales techniques: money back guarantees, direct mail, travelling salesmen, self-service, free delivery, illustrated catalogues and buy one get one free.

Great care was taken with opening times, and new products were held back to increase demand.

His warehouses in London became the most fashionable places to meet. Soon, showrooms were established in Bath, Liverpool and Dublin. All the produce was made in the custom-built estate and factory in Staffordshire, named Etruria after the Italian district famed for artistry.

A prominent abolitionist

Wedgwood was a prominent slavery abolitionist, derived from a friendship with the campaigner Thomas Clarkson. He mass-produced a slave medallion supporting the Society for Effecting the Abolition of the Slave Trade, which became the one of the most famous images associated with the abolition campaigns.

Thomas Clarkson described the success of the medallion:

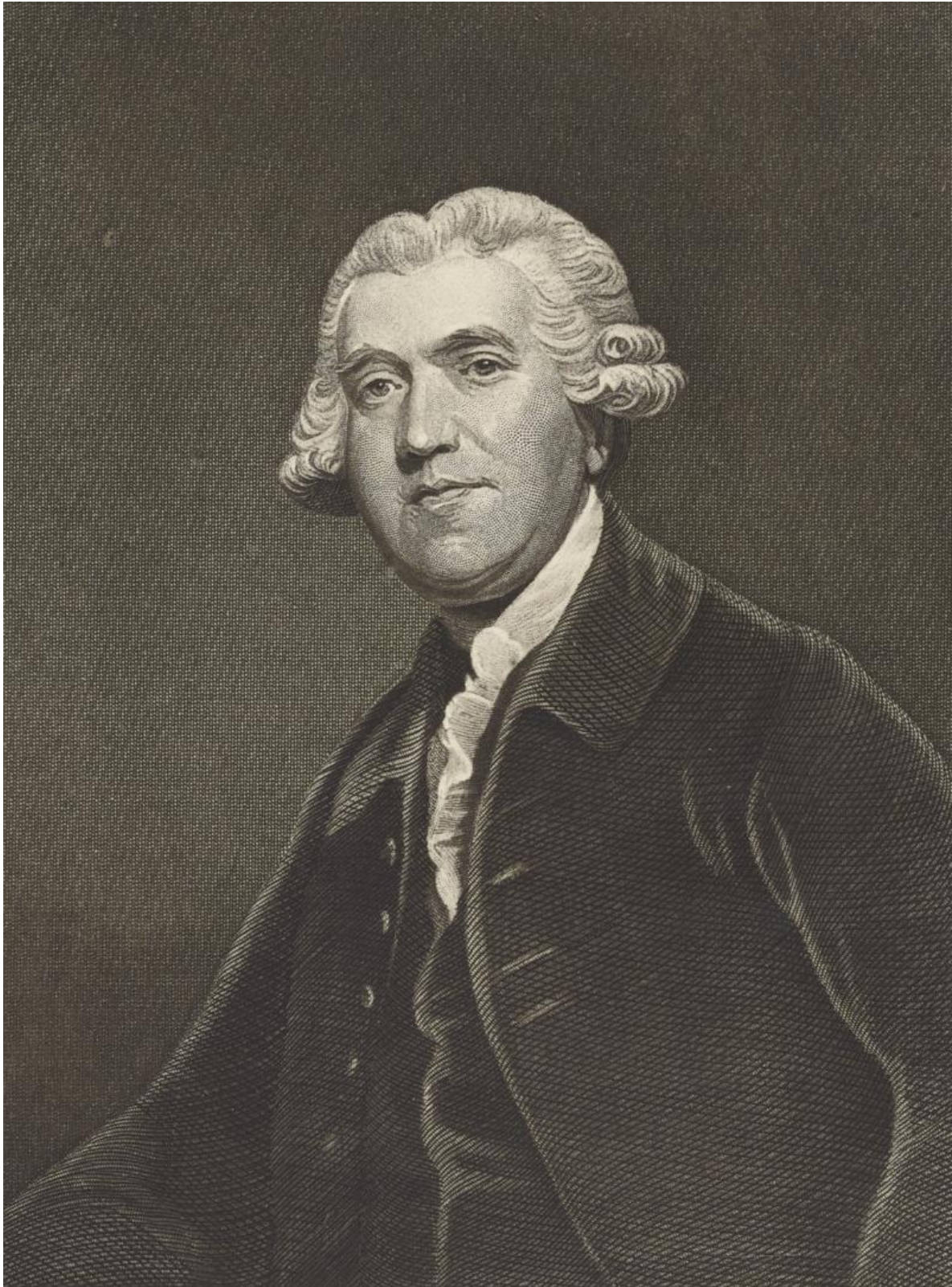
'ladies wore them in bracelets, and others had them fitted up in an ornamental manner as pins for their hair. At length the taste for wearing them became general, and thus fashion, which usually confines itself to worthless things, was seen for once in the honorable office of promoting the cause of justice, humanity and freedom'

A family of innovators

Wedgwood was a good friend of the physician, botanist and poet, Erasmus Darwin. On the death of his business partner, Thomas Bentley, Wedgwood asked Darwin to help manage the business. A result of this close association was the marriage of their children: Robert Darwin married Susannah Wedgwood.

One of their children – the grandson of Josiah – was Charles Darwin, who proposed the first theory of evolution through natural selection. The great inherited wealth of Wedgwood success funded Charles' place on the Voyage of the Beagle and

provided a private income to sustain the vocation of natural history. He would then marry another Wedgwood, his first cousin Emma.



Portrait of Josiah Wedgwood

A Luminary of British Romanticism: Who Was J. M. W. Turner?

By Alice Loxton

Joseph Mallord William Turner was born on Maiden Lane in Covent Garden in 1775. His father, William Turner, was a barber and wig-maker.

Throughout his life he would remain true to these roots – unlike many other artists who bent to societal refinement, Turner retained a thick cockney accent even at the pinnacle of his professional career .

A capacity for artistic skill was evident at an early age. At 14, in December 1789, he entered the Royal Academy Schools, where he began drawing casts of ancient sculptures in the Plaister Academy.

He was accepted to the Academy by Sir Joshua Reynolds the following year, where he progressed to life classes and work experience with architects and architectural draughtsmen.

Unlike young men of culture before him, Turner was unable to travel on a Grand Tour of Europe due to the Revolutionary and Napoleonic Wars – although he did visit Italy later in his life.

Not to be disheartened, he toured the Midlands in 1794, the North in 1797, Wales on several occasions and Scotland in 1801. This exploration of the British Isles is sure to have contributed to his deviation from the styles of Old Masters, who were heavily influenced by the Italian Renaissance.

Recognition at the Royal Academy

He first exhibited at the Royal Academy in 1790, and initial commissions were architectural and topographical watercolours – views of Salisbury, the estate at Stourhead and Fonthill Castle. However, he soon explored themes in history, literature and myth.

His work was received with great acclaim and he was soon labelled a prodigy. It was no surprise when he was elected an associate of the Royal Academy in 1799 and Academician in 1802, at which time he moved to a smarter address at 64 Harley Street.

In 1808 he was appointed as Professor of Perspective, meaning he added 'P.P.' to the 'R.A.' after his signature.

Whilst teaching at the Academy, Turner produced a prolific amount of work. At his death he left behind more than 550 oil paintings and 2,000 watercolours.

A pioneer of Romanticism

A key figure in Romanticism, alongside artists like John Constable, Turner chose to unearth the extreme drama in natural scenes.

Nature, once considered pastoral and benign, could be seen as beautiful, powerful, unpredictable or destructive. His imagination was sparked by shipwrecks, fires and wild natural phenomena such as sunlight, rain, storm and fog.

He was celebrated by the art critic John Ruskin who described his ability to:

'stirringly and truthfully measure the moods of Nature'

'Snow Storm: Hannibal and his Army Crossing the Alps' was painted in 1812. It depicts the vulnerability of Hannibal's soldiers who sought to cross the Maritime Alps in 218 BC.

As well as a curving black storm cloud filling the sky, a white avalanche crashes down the mountain. In the foreground Salassian tribesmen attack Hannibal's rear-guard.



'Snow Storm: Hannibal and his Army Crossing the Alps'

Turner painted many events of his own time, including the burning of Parliament in 1834, which he witnessed first-hand.



The Burning of the House of Lords and Commons (1835).

'The Fighting Temeraire tugged to her last berth to be broken up' was painted in 1838. The 98-gun HMS Temeraire played a decisive role at the Battle of Trafalgar. Here, the hero of a glorious epoch of the Royal Navy is sombrelly towed by a paddle-wheel steam tug towards south-east London, to be broken up for scrap.

The old ship maintains a stately splendour, her ghostly colouring contrasting to the blackened tugboat and smokestack – the symbol of the new age of industrialism.



The Fighting Temeraire. (1838)

In 1781, the captain of a slave ship 'Zong' had ordered 133 slaves to be thrown overboard in order to collect insurance payments. Turner depicted this in 'The Slave Ship'.

It was an event which shocked the British public, and propelled campaigns for abolition. Although slavery was abolished in the British Empire in 1833, it remained legal in other parts of the world, and was still a topic of debate at the time of Turner's painting in 1840.



Slavers Throwing overboard the Dead and Dying – Typhoon coming on (1840).

Turner wrote a poem to accompany the work

*Aloft all hands, strike the top-masts and belay;
Yon angry setting sun and fierce-edged clouds
Declare the Typhon's coming.
Before it sweeps your decks, throw overboard
The dead and dying – ne'er heed their chains
Hope, Hope, fallacious Hope!
Where is thy market now?*

Ruskin, the first owner of 'The Slave Ship', wrote about the work:

'If I were reduced to rest Turner's immortality upon any single work, I should choose this'

In 1844, Turner's interest in industry and technology drew him towards the steam revolution championed by Isambard Kingdom Brunel.

In 'Rain, Steam, and Speed – The Great Western Railway', a steam engine hurtles towards us as it crosses the Maidenhead Railway Bridge, completed in 1838. The two arches of the bridge were the widest and flattest ever built anywhere in the world at the time.

The Board of the GWR were so sure the bridge might collapse that they insisted the scaffolding was kept up, even once it was completed. Brunel duly obeyed, but secretly lowered the scaffolding so it washed away at the next flood, and proved the strength of his design.



Rain, Steam and Speed (1844).

Turner took great interest in these events. Like many Victorians, he was thrilled by the potential of modern technology. In his painting, the speed of the locomotive

bursting through the rain is accentuated by visual trickery, as the viaduct has exaggeratedly abrupt foreshortening.

Turner's intensity of light placed him in the vanguard of English painting, and had a profound effect on French Impressionists – Monet carefully studied his work. However, it had not always been appreciated.

In earlier years, The Royal Academy President, Benjamin West, denounced it as 'crude blotches', and he was tarnished as a 'white painter' because of the use of luminous, pale tones.

A troubled artist

Throughout his life, Turner was an introspective and troubled character. As a young adult he was briefly admitted to St Luke's Hospital for Lunatics in Old Street in 1799 and then Bethlem Hospital in 1800.

At the Royal Academy, he seemed to be a mixed blessing, as he was often reported to be pushy and aggressively rude. Joseph Farrington, who supported Turner's election as an Academician, described him as 'confident, presumptuous – with talent', but later regarded him to be troubled by 'puzzled incomprehension'.

As he grew older, he became increasingly reclusive, eccentric and pessimistic – and his art grew wilder and more intense. His father's death provoked bouts of depression and poor health, and his gallery fell into disrepair.

He never married, although he bore two daughters by his housekeeper: Eveline and Georgiana.

He died of cholera in 1851 and is buried near Sir Joshua Reynolds in St Paul's Cathedral.

What Were Isambard Kingdom Brunel's Greatest Achievements?

By Alice Loxton

Victorian Britain is famed for championing innovation and invention, fuelled by vast mass production and industrialisation.

These capabilities were realised most brilliantly through the tunnels, bridges and ships of Isambard Kingdom Brunel, the great engineer who sought to connect the world through his masterpieces in iron.

A natural talent

Brunel's parents, Marc Isambard Brunel and Sophia Kingdom, met in Paris during the French Revolution. As a known royalist, Marc fled to New York. Sophia, who remained in Paris to finish studying, was suspected as a British spy and thrown in prison until the Revolution subsided.

The couple reunited in England and married in 1799. In 1806, Sophia bore a son, Isambard Kingdom, who took his names from both parents.

Isambard's childhood was happy, albeit tainted with the family's financial problems. His father was a brilliant engineer and inventor, developing methods to mass produce ships' pulleys, amongst other things. Despite this, Marc Brunel ran up debts and was held in debtors' prison.

After three months it became public knowledge Marc was planning to be bailed out by Alexander I of Russia, and move his family to St Petersburg. Under pressure from the likes of the Duke of Wellington, the British government relented and cleared his debts, on the condition he remained in Britain and put his talent to use.

Isambard Brunel showed a natural talent for engineering and mathematics from a young age. He was encouraged to draw buildings and had started learning Euclidian geometry by the time he was 8 years old. He was sent to France to apprentice under

Louis Breguet, France's most celebrated maker of watches and scientific instruments.

At 20, Brunel helped his father design and construct the 1,300 foot Rotherhithe Tunnel, which undercuts the Thames between Rotherhithe and Wapping.

The father-son team developed a tunnel shield to protect the workers 75 feet under the river, where raw sewage and ignited methane gas was prevalent. Prince Albert took a keen interest, and Marc's efforts were rewarded with a knighthood.

Clifton Suspension Bridge

In 1830, Bristol was in need of a new bridge. Brunel submitted four designs to the committee, which was headed by Thomas Telford. All entries were rejected, and Telford's own designs proposed. Public outcry forced the committee to hold a competition, which Brunel won.

When it was constructed, the 700-foot bridge over the River Avon was the longest span of any bridge in the world. The two masonry towers, which reached 245 feet above the river gorge, held the roadway through tensioned cables.

This method used drastically less material and proved to be far cheaper. The bridge faced many problems in the early years and wasn't completed until 1864. Despite this, it remains in use for over 4 million vehicles each year.

The Great Western Railway

In 1833, Brunel was appointed as chief engineer of the Great Western Railway, an ambitious project aimed to link London to Bristol through a 124-mile railway route. After weeks of researching and surveying the geography, Brunel chose the flattest route.

Despite this, many obstacles remained. Rivers, valleys and hills were combated through innovative viaducts, bridges, stations and tunnels. The 1.8-mile Box Hill Tunnel in Wiltshire was greatly celebrated as the longest railway tunnel of its time, and with such an accolade, it was bedecked with a grand classical design.

The GWR enabled towns such as Swindon and Reading to become some of the fastest growing of 19th century Europe. The location of locomotive sheds in these towns demanded a need for housing for workers, which gave Brunel the impetus to build hospitals, churches and housing estates.

As the main terminal for GWR, Brunel worked with the architect Matthew Digby Wyatt from 1838 to design Paddington station. It was heavily influenced by the Joseph Paxton's glass design for the Crystal Palace. The first train left the station on 16 January 1854.

Steaming across the Atlantic

In 1836, Brunel married Mary Elizabeth Horsley, the eldest daughter of composer and organist William Horsley. They established a home at Duke Street, Westminster.

From around this time, the newly married Brunel began to design steamships for transatlantic voyages. He hoped to extend the journey of the GWR not only from London to Bristol, but onwards to New York by steamship.

In 1838, the SS *Great Western* was launched. She was the first steamship purpose-built for crossing the Atlantic and used regularly for transatlantic passenger travel between 1838 and 1846. She was an iron-strapped, wooden, side-wheel paddle steamer which had four masts to hoist auxiliary sails.

Brunel went one further in 1843, when he launched SS *Great Britain*, the largest ship of her time. Regarded as the first modern steamship, she was built of metal, powered by an engine and driven by propeller rather than paddle wheel.

In the same year, Brunel accidentally lodged a half-sovereign coin in his windpipe as he performed a magic trick for his children. Forceps and a specially designed machine failed to shake it loose.

At the suggestion of his father, he was strapped to a board and turned upside down, finally jerking the coin free. He spent time recuperating at Teignmouth, which he enjoyed so much he purchased an estate there.

The Renkioi hospital

When Britain entered the Crimea war in 1854, many British soldiers suffered from cholera, dysentery, typhoid and malaria. Florence Nightingale sent a plea to *The Times* for the government to produce a solution. In response, Brunel was asked to design a pre-fabricated hospital which could be transported to Turkey and quickly constructed.

The Renkioi hospital provided access to sanitation, ventilation, drainage, and even rudimentary temperature controls – designs which are still used today. Some sources claimed that out around 1,300 patients treated in the hospital, there were only 50 deaths. Florence Nightingale described them as ‘Those magnificent huts’.

Brunel’s final and most ambitious project was SS *Great Eastern*. It was built to take passengers non-stop from London to Sydney. The maiden voyage was a disaster, as the ship was damaged by an explosion.

Brunel himself never knew of such events. As he tested SS *Great Eastern*’s engines before she set sail, Brunel had a stroke on the deck, probably as a result of a lifetime of heavy smoking. He returned to his home at 18 Duke Street where he died 10 days later, aged 53.

His success derived from a lifetime of constant innovation and ingenuity:

‘I am opposed to the laying down of rules or conditions to be observed in the construction of bridges lest the progress of improvement tomorrow might be embarrassed or shackled by recording or registering as law the prejudices or errors of today’

What Was The Great Exhibition and Why Was It So Significant?

By Alice Loxton

In the summer of 1851, Joseph Paxton's glittering 'Crystal Palace' sprung up on the lawns of Hyde Park. Inside, it held a spectacular exhibition displaying the world's best inventions and innovation.

Marvelled at by about a third of the British population, we cannot underestimate the significance of such an event.

So what was it, and why did it happen?

Prince Albert's vision

Between 1798 to 1849, the 'Exhibition of Products of French Industry' had thrilled and delighted Parisian audiences, displaying the best products of French manufacturing. Inspired by this success, Prince Albert, the husband of Queen Victoria, was determined not only to copy, but better his French rivals.

His vision was to hold a huge exhibition in London, displaying the best inventions of the world – the 'Great Exhibition of the Works of Industry of All Nations'. After striking up a surprising friendship with Henry Cole, an assistant record keeper at the Public Records Office, the two men set out to fulfil Albert's vision.

Together, they attained government permission, whose heavy scepticism was transformed to enthusiasm when the project was declared to be self-funding. They realised it could be a beacon of a new age of peace and prosperity and a celebration of the British manufacturing boom.

After two challenging decades of political and social discord, Albert sensed this new era of prosperity, as he wrote to his cousin, King William of Prussia,

'we have no fear here either of an uprising or an assassination'.

Paxton's triumph

The Exhibition needed a venue, vast enough to contain displays from every corner of the world. No such building existed in London, and a temporary design was submitted by Joseph Paxton, the famed gardener of the 6th Duke of Devonshire.

His proposal was a modified version of a greenhouse he had already built for the Duke. It was made of a cast iron-frame and glass.

This enormous glasshouse could be fabricated off site; it could be quickly reconstructed and deconstructed. Overseen by a committee including Isambard Kingdom Brunel, and built by around 5,000 navvies, it was up in just nine months.

The structure was 1,850 feet long and 108 feet high, three times the size of St Paul's Cathedral. Its shimmering glass gave it the nickname, 'The Crystal Palace'.

The Exhibition opens

Paxton's design was delivered on schedule, allowing Queen Victoria to open the Exhibition on 1 May 1851. This wasn't without controversy.

Many radicals, such as Karl Marx, openly condemned it as a repulsive tribute to capitalism. Would these views incite the immense crowds to become an enormous revolutionary mob? Such concerns proved needless, as the remarkable attractions seemed to overwhelm any potential for radical action.

Entry was strictly ticketed. At the start of the summer, it was priced for wealthy Londoners. However, as the parliamentary season drew to an end and this group began to leave the city, ticket prices gradually dropped to one shilling.

Thousands poured in from the industrial classes, mobilised by a new network of railway lines. Employers sent factory workers, landowners sent country villagers and schoolchildren and churches organised group outings. One old lady walked from Penzance.

A display of 'every conceivable invention'

Albert had organised over 100,000 objects presented by about 15,000 exhibitors.

Although the Exhibition was supposed to showcase 'All Nations', the exhibitors from the British Empire were so numerous that it seemed more a celebration of Britain.

The biggest exhibit was an enormous hydraulic press that had lifted the metal tubes of a bridge at Bangor. Each tube weighed 1,144 tons, yet the press could be operated by one worker.

Visitors could watch the entire process of cotton production from spinning to finished cloth. There were printing machines turning out 5,000 copies of *Illustrated London News* in an hour, printing and folding envelopes and making cigarettes.

There were folding pianos to be used by yachtsmen, 'tangible ink' which produced raised characters on paper, to aid the blind, and a pulpit connected to pews by rubber tubes so deaf parishioners could keep up.

Victoria recorded that 'every conceivable invention' was displayed – in pottery, ironwork, firearms, houses, furniture, perfumes, fabrics, steam hammers or hydraulic presses.

The American display was headed by a massive eagle with wings outstretched, holding the Stars and Stripes. Chile sent a single lump of gold weighing 50kg, Switzerland sent gold watches and India, an elaborate throne of carved ivory.

The Russian display was late, having been delayed by ice in the Baltic. Eventually, they brought huge vases and urns twice the height of a person, furs, sledges and Cossack armour.

A crowning glory of the exhibition was the famous Koh-i-Noor diamond, its name meaning 'Mountain of Light'. It was acquired in 1850 as part of the Lahore Treaty, and in 1851 it was the world's largest known diamond.

A four-ton fountain of pink glass, 27 feet high, helped to cool the atmosphere, and full-size elm trees grew inside the structure.

When sparrows became a nuisance, the Duke of Wellington offered a solution to the Queen: 'Sparrowhawks, Ma'am'. Another first of the Great Exhibition were the

‘waiting rooms and conveniences’, where visitors could spend one penny to use a private cubicle.

A jewel of Victorian Britain

When the exhibition closed on 15 October, six million people had visited, equivalent to one third of the British population. Amongst this six million was Charles Darwin, Charles Dickens, Charlotte Brontë, Lewis Carroll, George Eliot, Alfred Tennyson and William Makepeace Thackeray. Queen Victoria and her family visited three times.

The exhibition’s success was accentuated by impressive financial success. It made a surplus of over £18 million in modern money, allowing Albert to establish a museum complex in South Kensington, nicknamed ‘Albertopolis’.

This encompassed the Victoria and Albert Museum, the Science Museum, the Natural History Museum, the Imperial College of Science, the Royal Colleges of Art, Music and Organists and the Royal Albert Hall.

Paxton’s dazzling glass design was later moved and re-erected in 1854, at Sydenham Hill, an area renamed as Crystal Palace. This was destroyed by fire on 30 November 1936, and never rebuilt.



The Crystal Palace in Hyde Park, London, in 1851.

What Was It Like to Ride a Victorian Luxury Train?

By Martyn Pring

Most people believe luxury train travel was the product of the 20th century's inter-war years.

While it is true that some of the most illustrious luxury trains were firmly entrenched in this period, the history really unfolds much earlier.

Towards the end of Victoria's reign

Ideas surrounding luxury rail travel really began in the mid-1880s, when society was on the move and the Old World was attracting tens of thousands of new international visitors.

In Britain there had been some railway company experimentation. However the notion of civilised travel arrangements had hardly moved on from 1862, when new Anglo-Scottish expresses were made up of primitive 4 and 6-wheeled non-connecting carriages.

This was the norm before two 4-wheeled (and later 6-wheeled) bogie stock caught on. Sprung bogie construction was still some time off to enable a smoother passenger ride.

Some railway companies like the Midland were true trailblazers with "luxury 12 wheelers". Others remained unconvinced of benefits they delivered, citing the fact that they were heavier, required more powerful locomotives, and were a prerequisite for greater investment and capital expenditure they were loath to spend on.

For travelling passengers, the advantages were self-evident; new bogie carriages provided greater comfort and freedom to move around.

The Orient Express

The launch of the Orient Express in October 1883 provided a pivotal moment in the development of the luxury train concept.

The initial service linking many European capitals ran with two sleeping car saloons and a dining carriage sandwiched between the two fourgons or luggage cars.

However it was the idea of a better travelling experience with sumptuous accommodation that caught the media's eye.

The launch event and the celebration of cuisine delivered by a small band of chefs working in cramped conditions was universally received with journalistic plaudits and especially with British audiences, who went on to form the majority of the luxury train's customers.

The return journey lasted 11 days, but clearly demonstrated Georges Nagelmackers' uncanny ability to negotiate complex travel arrangements involving national institutions and myriad railway companies across the pockets of European states.

Railway route expansion fuelled the expansion of first-class trains largely driven by a combination of railway competition and increased traveller expectation.

A better way to travel

The 1890s marked a significant step-change in Britain and how railway companies saw their customers. They belatedly realised passenger expectancies surrounding the quality of travel; services were clearly evolving.

It was a decade of rapid and bewildering change as science and technology transformed the country, giving rise to the modern world. The bigger railway companies were a key lever of industrial expansion altering everything around us forever.

Whilst railways possessed the infrastructure to effect change, society as a whole was knocking on their doors demanding transformation.

An educated and moneyed upper and middle-class, benefiting from the professionalisation of society (on both sides of the Atlantic), demonstrated personal ambition, self-confidence and a willingness to tap into life's better things.

Railway companies and shipping lines were the new conduits of better ways to travel.

The age of decadence

The end of the Victorian age was discernible as a period of decadence and interest in arts, popular culture and the written word altering the travel landscape and demand for luxury products and services.

Frequent and short breaks were now on travel agendas – railways got you there fast. Domestic and overseas travel became cornerstones of urbane lifestyles.

Notions surrounding adventure, walking, outdoor pursuits, culture and heritage registered ever more prominently on peoples' radars.

From the 1890s decadent places to stay, restaurants, eateries and new concepts surrounding the luxury floating palaces of trans-Atlantic liners and their accompanying boat trains were on architect and designer drawing boards – but constructed to mirror society's accepted class segregation.

The British Pullman Company

So how did all of these ideas transform themselves into better ways to travel by rail? Certainly increased use of longer and spacious bogie carriages provided improved passenger comfort and facilities.

Gangway/corridor connected stock with compartments and lavatories became the norm. Some railway companies invested in raised clerestory roofed coaches providing more natural light; elliptical shaped roofs became the standard from Edwardian times when aided by new electric lighting technologies.

This came about in 1894 when dynamos were attached to bogie wheels; dimly lit coaches on premier services were consigned to the past.

One of the first benefactors were the London, Brighton and South Coast Railway's (LBSCR) Brighton Pullmans and Newhaven boat trains.

It was the beginning of 'Pullman and Deluxe train travel' whispered in the same breath as the British Pullman Company came under new ownership.

A golden era of train travel

Improved gas technologies also provided safer environments for lighting, food preparation, cooking and the dining carriage, although in the event of collision and derailment, seeping gas was always a potential fire hazard with wooden constructed coaches.

High-quality dining cars provided sophisticated "food on the move" rail travel for both first and third-class passengers.

On the continent, it was more complex as second-class travel still existed, but British food service developments were innovative; new third-class diners were akin to first-class of other railway companies.

Similarly, first-rate sleeping car services on long-distant runs were ever more pleasant places especially on the consortia led Anglo-Scottish expresses. Viewpoints of "hotels on wheels" entered everyday language.

After a difficult start in Britain, The Pullman Company gradually gained a foothold on LBSCR and South Eastern and Chatham Railway (SECR) services providing some of the first named luxury trains.

By Edwardian times affluent first-class passengers increased substantially; the new Southern Belle Pullman was described as "The Most Luxurious Train in the World" when launched in 1908.

Visitors from the New World

One of the major drivers to the extension of luxury facilities enjoyed by period travellers was the value and numbers of New World tourists coming to Britain.

The impact of the US source market in shaping luxury travel agendas in this country was a significant signature of the times.

New classes of trans-Atlantic liners could be found; the first-class “floating palaces” reflected the value of American visitor economy and exercising a profound influence as all involved recognised the high-spending potential.

Travel providers – railway companies, shipping lines and hoteliers – went out of their way to provide simply the best.

South Eastern Railway. London-Chatam-Dover Railway
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ORIENT EXPRESS

HIVER 1888-89 WINTER 1888-89

LONDRES-PARIS-VIENNE
LONDRES (Waterloo) Départ 8 + 20 (12.00) LONDRES (Charing-Cross) Départ 8 + 40 (12.00)
CLARE (Gare maritime) Départ 10 + 20 (12.00) BUDAPEST Arrivée 10 + 15 (12.00) Thursday
Tous les Jours Départ 10 + 40 (12.00) PARIS (Gare de l'Est) Arrivée 1 + 30 (12.00) Friday
MUNICH Arrivée 1 + 30 (12.00) Every Day
VIENNE Arrivée 10 + 15 (12.00) Saturday

PARIS-CONSTANTINOPLE
Mercredi PARIS (Gare de l'Est) Départ 7 + 30 (12.00) Wednesday
Jeudi VIENNE Arrivée 10 + 15 (12.00) Thursday
Vendredi BUDAPEST Arrivée 5 + 25 (12.00) Friday
Samedi BELGRADE Arrivée 30 (12.00) Friday
Dimanche CONSTANTINOPLE Arrivée 6 + 40 (12.00) Saturday

PARIS-BUKAREST
Jeudi et Dimanche PARIS (Gare de l'Est) Départ 7 + 30 (12.00) Thursday and Sunday
Vendredi et Lundi VIENNE Arrivée 10 + 15 (12.00) Friday and Monday
Samedi et Mardi BUDAPEST Arrivée 4 + 00 (12.00) Saturday
BUKAREST Arrivée 50 (12.00) and Tuesday

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Poster advertising the Orient Express.

Who Was William Morris and Why Was He Important?

By Alice Loxton

Many people might recognise William Morris as a name associated with a mediaeval-style floral pattern, often adorning curtains or sofas.

However, William Morris was a major figure of Victorian society. He was a pioneer in the Arts and Crafts Movement, a celebrated innovator in the British textile industry, and an important political activist in the early days of the British Socialist League.

So how did Morris become such a noteworthy figure?

An idyllic childhood

Morris was born in Walthamstow, London, in 1834. His father earned huge sums of money as a broker, blessing his son with an inheritance so large he was never troubled about earning an income.

From 1848 to 1856, in his teenage years, Morris lived in Water House (now the William Morris Gallery), spending school holidays boating and fishing in the moat. His lifelong love of landscape, buildings and historical romance was inspired by these idyllic surroundings.

From his youth, Morris had a strong moral compass and social awareness. He was disgusted by the industrialism of the Victorian age, believing society based on mass production created alienation and division. When he visited the 1851 Great Exhibition at the age of 16 he refused to enter, repelled by the 'ugliness' of what he expected to find there.

Oxford University and 'The Set'

When Morris was at Oxford University he met Edward Burne-Jones, who shared his views about the decline of the modern world. Burne-Jones introduced him to a group who were known as 'The Set' or 'The Brotherhood'. They enjoyed reading medieval

history, chronicles, and poetry, which celebrated themes of romantic chivalry and self-sacrifice.

Perhaps inspired by the beauty of Oxford's honey-coloured architecture and the late night discussions with this new group of friends, Morris developed a lifelong love of medieval history and art.

Combined with his hatred of modern industrialisation, Morris sought to return to a medieval system that supported craft through artisan guilds, thereby raising the status of the artist or manufacturer. His vision was a world away from Victorian Britain, where the status of the individual maker had been relegated to just another cog in a machine.

His ideas were greatly influenced by John Ruskin, a prominent social critic, who also disapproved of the dehumanisation of mass production. Industrialisation, he believed, would eventually be the ruin of art and culture, and by this logic, it would lead to a destruction of civilisation.

Morris believed nature was not to be conquered, but respected. The beauty of objects did not lie only in the visual aesthetic, but also in the skill of the craftsman. The Arts and Crafts style which developed in art, furniture design and architecture drew upon several key principles.

These principles specified only natural and local materials should be used, vernacular styles should be created from domestic, traditional techniques, simple forms should expose the construction processes, extravagant decoration was unnecessary, and natural motifs (such as the flora and fauna of the British countryside) were a favourable theme.

Red House

Morris' ideas materialised in Red House, a new family home designed by Phillip Webb in Kent. The design aimed to be true to its materials and expressive of the site and local culture. When Rossetti saw it for the first time, he declared it

'more a poem than a house'

Along with several friends, who thrived in the 'joy in collective labour', huge murals and hand-embroidered fabrics adorned the walls, creating a sense of an ancient manor house.

Every detail was taken into account – Morris custom-designed furniture, glassware, candle-sticks, chairs, picture-hooks and finger-plates. It was 'very medieval in spirit' – more a simple design harking back to the houses of the ordinary man, rather than the fussy mid-Victorian architecture then in fashion.

Morris & Company

In 1861, Morris founded the Morris, Marshall, Faulkner & Co decorative arts firm with Burne-Jones, Rossetti and Webb. They brought together craftsmen of all kinds under one studio, and sought to apply Ruskin's philosophy to business. For Morris, this meant striving to achieve beautiful designs which remained functional. He wrote,

'Have nothing in your houses that you do not know to be useful or believe to be beautiful.'

The medieval style of Morris's work was incredibly successful and became considered quintessentially English. His principled approach to craftsmanship and labour became a model for a number of craft guilds and art societies.

In 1875, Morris & Company was founded as Morris took control of the company. It sold printed and woven fabrics, wallpapers, designs for carpets, rugs, embroidery and tapestry. They were sold in his shop on Oxford Street, which offered an innovative 'all under one roof' retail experience.

Despite his privileged background allowing him to thrive off a generous inheritance, Morris became increasingly frustrated with politics, and founded the Socialist League in 1884. Protected against the disapproving establishment by his fame and success, Morris went on socialist marches and made numerous street-corner speeches.

At Morris' death in 1896, he was a household name, and his designs have enjoyed popular success to the modern day.

The Extraordinary Daddy-Long-Legs Railway of Brighton

By Martin Easdown

The short-lived Brighton & Rottingdean Seashore Electric Railway must have presented quite an amazing spectacle even during those late Victorian days of engineering excellence.

Affectionately known as the 'Daddy-Long-Legs', but also termed the 'spider car', 'sea-going car' 'sea-going railway' and 'sea tramway', it presented the amazing spectacle of a part tram, part boat, part seaside pier moving by itself through the sea.

Built by Magnus Volk as an extension of his Volk's Electric Railway, which opened in 1883 and is the oldest electric railway still running today, the Daddy-Long-Legs ran for only five years before new sea defence works forced its closure in 1902. Yet, over a century later, the Daddy-Long-Legs leaves a lasting impression on everyone who sees the old photographs of it, and it rather typifies Brighton's 'Bohemian' aspect.

Construction

Permission was granted for the railway on 27 July 1893 and construction commenced the following year. However, progress was slow because the line was submerged under the sea for much of the time.

The first part of the project was to construct the pier at Rottingdean. On 11 June 1895 a light steel structure of 91 metres in length and 6 metres in width was situated just to the west of Rottingdean Gap, to which it was connected by a short walkway.

The pier stood 9 metres clear of high water and steps led down from the pier head to the landing stage. Beneath the head was located the railway's generator of electricity, a 60kw 500w steam generator. This provided electricity to power the railway. The current passed through the 24ft high pier-like legs to the driving wheels

and brakes. The car ran upon two parallel lines of rails. Concrete slabs laid on the seabed supported the rails.

The platform of the car consisted of an upper open deck with seating and a luxury saloon on the lower tier. This was fitted with a fine upholstered Ottoman down its centre, stained glass windows, carpet, potted plants and aspidistras, heavy curtains and a refreshment booth. The builder was the Gloucester Wagon Company and the car was officially named 'Pioneer'.

Up and running

Eventually, on 28 November 1896, after costing £30,000 to build, Magnus Volk opened his new wonder railway through the sea with an official ceremony at the Brighton terminus.

The public service commenced two days later, and unsurprisingly the railway was initially a great success with large crowds flocking to the terminus at Paston Place to patiently await their turn to experience a ride through the sea.

However, disaster was to strike on 4 December 1896 when a severe gale wrecked both the Paston Place terminus and Pioneer, after it had broken loose from its mooring at Rottingdean Pier.

Undeterred, Volk rebuilt Pioneer (with taller legs) and built a new smaller landing stage off the Banjo Groyne, enabling the service to be resumed on 20 July 1897. A request stop was opened at Ovingdean Greenway Gap using a rather fragile sloping wooden landing stage.

On 20 February 1898 the Prince of Wales took two trips on the railway, but for the general public, a ride on Pioneer was only accessible for those wealthy enough to pay the 6d fare each way.

An hourly service was provided from Rottingdean in the summer, although short trips from Banjo Groyne became increasingly popular due to a journey along the full length of the line and back taking up to 1½ hours to complete at an average speed of

only 6mph. At high tide the car would crawl at a walking pace and for some the journey could become quite tedious.

Breakdowns were also common, causing the timetable to be suspended for weeks on end, whilst bad weather also brought the service to a halt. However, there was no denying a journey on Pioneer was a unique and unusual experience, especially when it was ploughing through a high tide of 15 feet of water.

Closure

Unfortunately, the life of the Brighton & Rottingdean Seashore Electric Railway was to be all too brief. During the summer of 1900, the service had to be suspended when the track was damaged by the scour from the construction of two concrete groynes, built to prevent erosion of the cliffs.

Then on 1 September 1900 Brighton Corporation gave Volk two months' notice to relocate the track at Kemp Town southwards to make room for groyne extensions. Volk suggested building a new terminus at Black Rock, and extending his shore railway to it, but this was rejected.

In February 1901 the Borough Surveyor removed a section of the track and the service was suspended. It was officially abandoned the following year. However, in compensation, Volk was given permission to extend his Volks Railway to Black Rock.

The elegant Pioneer was tied up at the Ovingdean landing stage, where it was left to die a slow death until it was removed for scrap in early 1910. The pier at Rottingdean had been removed by December 1911.

Some of the concrete blocks which supported the rails survive to this day leaving, at low tide, a visible reminder of the line's existence. Stumps of some of the wooden poles that supported the overhead wire can also be seen.

Volk's unique and imaginative railway through the sea was, in the end, probably a failure. However, its uniqueness has ensured it has an honoured and treasured place in the annals of British seaside history.

Who Was Philip Astley? The Father of the Modern British Circus

By Mike Rendell

In the early days of Philip Astley's Riding School, he would give riding lessons in the morning in a disused field in Lambeth, and in the afternoon he would get his pupils to "put on a bit of a show" by entertaining passers-by with exhibitions of trick-riding and so on.

The founder of the modern circus, Astley would go on to lease premises near Westminster Bridge and gave exhibitions based around his riding skills – riding 5 horses at once, or jumping on and off horseback, or vaulting a coloured ribbon and landing back on the horse.

Bringing in the clowns

The breakthrough came when he had the idea to add street performers to his act.

Jugglers and acrobats had existed for centuries but only as separate performers at fairs and country shows. What really made the transition to all-round family entertainment was when Astley pioneered a "marriage" between equestrianism and clowning.

Clowns had been around for a long while, but Astley was the first to link it with horse riding. In particular he launched an act called 'The Tailor of Brentford'.

A gaudily dressed tailor, played by Astley, would announce that he was in a hurry to get home to Brentford to be able to cast his vote in a general election.

He would run over to his horse which, at the last moment, would take two steps forward, leaving Astley sprawled in the sawdust which lined the ring.

The horse would trot off while Astley tried to run after the animal – until the horse picked up speed and soon was the one chasing Astley, to the great merriment of the audience.

After repeated mishaps with the rider getting on the horse the wrong way round, or falling off, the horse and rider would finally get their act together and Astley would reveal his brilliant riding skills.

One day a member of the audience, apparently a tailor himself, objected to what he saw as a slur on his profession.

He was offered the chance to show the audience that he could ride, but no sooner was he mounted than Astley clicked his fingers – a hidden signal for the horse to drop to its front knees, thereby launching the hapless tailor head first.

The crowd loved it, and this “spontaneous” interruption to the act became a regular feature.

The bellowing horse whisperer

No wild animals were involved inside Astley’s ring. Elephants, tigers and lions had no part to play in the early circus.

For Astley, it was all about demonstrating the bond between horse and man. He had a unique way of training the horses with repetition followed by reward, followed by repetition and reward, over and over again.

Any disturbance to the training – for instance if a shot or loud noise was heard, then he would stop the lesson for the whole of the rest of that day. He must have been a striking figure – 6 foot tall, a burly sergeant-major of a man, with a bellowing voice.

Born in 1742 to a furniture maker in Newcastle under Lyme, he was expected to follow in his father’s footsteps but the young Astley wanted adventure – and he wanted to work with horses. So, he joined the army.

There he learned how to train horses for battle and he served with valour and distinction in the 7 Years War.

Not only did he capture the French colours in one battle, but in another he rescued a member of the British royal family by single-handedly riding through the enemy lines

to pick up the royal, who had become surrounded in the melee and needed to be dragged back to safety on board Astley's horse.

Astley was the "horse whisperer" of his day, but he was also a rough diamond and poorly educated. He was nevertheless extremely popular – not just with the general public, who flocked to see him in their thousands, but also with royalty, who were regulars at his circus performances. He revelled in the fact that he was on speaking terms with the king, George III.

Getting the show on the road

In time Astley performed in the open-air arenas and built permanent sites in Dublin, Paris and as far afield as Vienna. 19 permanent circus venues were established in Europe.

This family-friendly form of entertainment was developed by others and quickly spread to America, where they added the big top and introduced wild animals and a separate tent containing freak show exhibits.

But for Astley, it remained a demonstration of equestrian skills. Sadly, nothing really remains of his prowess – largely because he always insisted on building in wood and not stone, and so his amphitheatres kept burning down.

Over and over he would rebuild. He was a carpenter's son – and wood was what he felt comfortable with. He liked the idea of a structure which could be de-mounted and carted off around the country, taking the show to the people.

If it burned down then, well, he just set to and rebuilt it for the following season.

Under the stage limelight

Astley died in Paris on 27 January 1814 but his legacy – despite not getting the recognition it deserves – lives on in variety performances to this day.

Astley gave us jugglers, clowning, acrobats and "mind-reading" animals. He gave us brilliant horsemanship; he gave us slack wire dancing and human pyramids, and and all of it could be enjoyed by young and old alike.

His shows crossed all social boundaries – it was mass entertainment which was available to everyone.

Astley shares the spotlight with a host of people who are often overlooked when we consider who were the Greats of the Georgian era.

We tend to think of the Industrial Revolution – the James Watt's of the world – but there were an awful lot of people who had just as dramatic an effect on our world. Astley was most certainly one of them.