DESIGN

THE WHOLE STORY

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Foreword by
Jonathan Glancey

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◄ Calico printing at the Morris and Co workshop in Merton Abbey Mills, London, in 1931.

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FOREWORD

William Morris, designer, craftsman, and garrulous socialist, told a Birmingham audience in 1880: "If you want a golden rule that will fit everybody, this is it: Have nothing in your houses that you do not know to be useful or believe to be beautiful." Addressing a gathering in London the following year, he declared: "Simplicity of life, even the barest, is not a misery, but the very foundation of refinement."

Taken together, these two hallowed maxims underpin pretty much the entire history of design. That, at least, is the view of those—the Bauhaus, national design councils, and historians who have wanted a tidy story to tell—who believe that design has proceeded smoothly on Morris's rails ever since he laid them. Morris's own work was flamboyant and, as far as twentieth-century functionalists were concerned, his heart was in the right place. And certainly morality and good design have marched righteously together to create much of the work shown in core sections of this wide-ranging book.

For many decades—ever since, in fact, the Bauhaus, its disciples, and other high-minded moralists spread their mantra of "fitness for purpose"—the history of design has been taken to be a more or less seamless tale of steady progress, with beauty, truth, and refinement emerging as logical by-products of rational functionalism. The inessential decorations beloved in the nineteenth century were stripped away, like barnacles from the hull of a boat, as the design of everything, from teaspoons to trains, became ever more rational.

And yet, as later sections of *Design: The Whole Story* demonstrate, a popular desire for decoration, and also playfulness, texture, and color, has caused design to move almost full circle, back around to lively forms like the expressions of Art Nouveau and Art Deco, for example, that once annoyed Bauhaus professors, iconoclastic historians, and puritanical critics alike.

How have Post-modern and digital-era designers turned what seemed to be a logical story on its head? Turning the pages of this book, the answer becomes increasingly clear. Functionalist design reached its zenith when it was in the service of the public sector, or controlled by civic-minded individuals, businesses, and corporations. In recent decades, with the triumph of neoliberal economics and private enterprise, the wishes of individual consumers have been highly influential, and design has been primarily in their dedicated service. Just look at how, as evidenced in the later sections of this book, "personal" products, such as cellphones, miniature computers, automobiles, wallpaper, and decorative objects, have taken pride of place.

This makes sense. Design, like architecture, is influenced and guided by artistic, academic, moral, and even philosophical ideas, but what perhaps shapes objects most is the political economy. In the communist societies that emerged after the Russian Revolution, for example, consumer design was considered largely unimportant. For society in the early twenty-first century,

whether it is directed by the state, as in China, or by corporations and professional lobbyists, as in the United States, consumer design leads the way. And, because consumer desires are thought to be both catholic and insatiable, design has adopted a multitude of forms. Discipline, it might be said, has given way to decadence, and design, freed of moral strictures, has been liberated. Perhaps, though, this is a natural state of affairs. After all, design in nature—from the forms of plankton to planets, seahorses to stars, cactuses to constellations—exhibits infinite forms. And as design mutates and flowers in this natural way, so the certainties of strictly functionalist thinking have given way to a new relativism. Can anyone today say with absolute certainty what good design is? "Ask a toad what is beauty," teased Voltaire in his *Dictionnaire philosophique* of 1764, and "He will answer that it is a female with two great round eyes coming out of her little head, a large flat mouth, a yellow belly and a brown back."

And yet, in a time of ungoverned, haphazard relativism, it is easy to think fondly of eras in which highly purposed design was not only associated with public service but also taken intensely seriously, with enviable results. Think of the intelligent work that has been devoted, over decades, to design in the service of mail offices and state-owned railroads worldwide, of mail stamps and banknotes, of river ferries and electricity pylons, of school furniture and public information graphics.

That, though, is the subject of a different book. *Design: The Whole Story* shows you, boldly and well, how our modern notion of design came about, and what, in terms of the objects we have in our houses, design has become a quarter of a millennium after the Industrial Revolution.

JONATHAN GLANCEY
JOURNALIST, AUTHOR, AND BROADCASTER

INTRODUCTION

Design is hard to define. Most familiarly, as many of the key examples in this book demonstrate, it results in products that can be bought and sold—and eventually, if hallowed by critical approval, placed in museum collections. Yet design may also lead to something as amorphous as the Internet, which shapes every aspect of modern life and communication while remaining intangible. While design often involves problem-solving, it can also anticipate needs that have never been articulated before: in this sense, it is profoundly imaginative. Aesthetic judgement naturally comes into it, yet it is distinct from both art and craft. Similarly, while design can be primarily concerned with function and performance, it cannot be reduced to engineering or technical specification.

If by design we mean intent, then everything that has ever been made by human hands has been designed. In such terms, a pot shaped thousands of years ago and baked in the Mesopotamian sun is a product of design, every bit as much as a concept automobile or an iPhone. But design as a specialist process, or a practice that is distinct from making, has a much shorter history, and dates back only to the beginnings of the Industrial Revolution (see p.20).

Humans have always been toolmakers, but with the dawn of the Industrial Revolution the degree to which human technology could alter the world increased exponentially. The textile industry, which was the first to be mechanized, began the shift that would see the economies of the West transform from largely agricultural ones to those based on manufacturing.

In the late eighteenth century the drive for profit saw manufacturing rationalized into separate elements or processes; similarly, increased volumes theoretically meant lower unit costs and an opening of the market to a broader range of consumers. It was the concomitant need for planning and standardization over the production cycle that led to the emergence of design as a distinct discipline. This constituted a massive shift both in the way work was conceived and the manner in which goods were bought and sold.

▼ A high chest of drawers (*c.* 1700–20) made in North America from maple, walnut veneer, maple burl veneer, and pine. It personifies the high level of craftsmanship that William Morris regarded as under threat in the late nineteenth century.

Before long, however, the products of the new industrial age, with their often meretricious applied decoration and confused styling, ushered in a crisis of taste. Previously, there had been a broad consensus on what might loosely be termed "style." For much of the eighteenth century, classicism (see p.24), derived from the ancient Greek and Roman orders, informed the design of everyday objects as well as buildings. This underlying point of reference gave a remarkable unity to architecture, interiors, and what they contained.

By the second half of the nineteenth century, consensus was nowhere in evidence. Already, there was nostalgia in certain quarters for a preindustrial way of working and the period was marked by a series of revivals as critics and designers sought to determine an appropriate visual language for the age, a debate that was often couched in moral terms.

"Shoddy is king," was the estimation of William Morris (1834–96; see p.52) of the quality of goods pouring out of Britain's factories. The stylistic confusion on display at the Great Exhibition (1851; see p.38) led directly to calls for reform. That Augustus Pugin (1812–52) championed the Gothic as a morally appropriate style had a strong influence on Henry Cole (1808–82), founder of the South Kensington Museum (later the Victoria & Albert Museum). Cole's mission to educate the public in what constituted good and bad taste included a "chamber of horrors" where the worst stylistic offenders from the Great

◄ William Morris created the "Pimpernel" wallpaper design in 1876 and later chose it to decorate his dining room at Kelmscott House in Hammersmith, London. Its botanical motifs, complex structure, and swirling rhythms are typical of his style.

Exhibition were displayed, including a decorative stoat holding an umbrella. Other occupants of the high ground included John Ruskin (1819–1900), who exerted a powerful influence on Morris and his immediate circle.

The Arts and Crafts movement (see p.74), whose practitioners were hugely influenced by Ruskin and by the work of Morris, promoted an idealized notion of rural simplicity and honesty of construction, harking back to the Middle Ages and early craft guilds. At a time when Victorian clutter was at its greatest, the emphasis on unadorned craftwork sponsored a lightening of the interior, if only among an intellectual elite. Although the Arts and Crafts movement was not without its inherent contradictions, it was to have a significant influence on early twentieth-century design movements in Europe and North America.

During the same period, mass consumption really began to take hold and it was in the United States that mechanical and electrical goods were first produced for use in the home and the office. Advances in printing technology, such as lithography and the new hot-metal process, aided and abetted the advertisement and marketing of new products, in which design played an important role. The electric light bulb, invented by Thomas Edison (1847–1941), stimulated a demand for the supply of domestic electricity and, by extension,

► Joost Schmidt (1893–1948), a teacher at the Bauhaus, designed this poster to advertise a Bauhaus exhibition in the city of Weimar, Germany, in 1923.

appliances such as vacuum cleaners and washing machines that were powered by it. While branding has much earlier antecedents, it was also at this time that it began to emerge as a means of fostering consumer loyalty.

By the beginning of the new century, a rift was opening up between those who believed that there was room for individual artistic expression in design and those who argued that function should be the defining element. The latter part of the nineteenth century had been marked by two chief influences: Japonaiserie (see p.82) and Art Nouveau (see p.92). Both were highly decorative and pervasive in graphics and applied ornament. The short-lived Aesthetic Movement (see p.88) had a similarly febrile *fin de siècle* quality.

By 1913, when Henry Ford (1863–1947) devised his moving production line, functionalism had all but triumphed. Mass manufacture, a design process in itself, demanded standardization. While this had been true ever since the beginnings of industrialization, what had changed was the emphasis on "type-objects," products that proudly proclaimed their manufactured origins.

The machine aesthetic (see p.134), in the hands of masters of modernism such as Mies van der Rohe (1886–1969), Marcel Breuer (1902–81), Le Corbusier (1887–1965), and Charlotte Perriand (1903–99), took inspiration from both modern machines such as bicycles and ocean liners and new materials such

as tubular steel. Eschewing ornament of any kind, the emphasis was on pure form derived from function. Few early products of modernism were commercially successful in their time, but their legacy of influence has proved immense. Equally lasting were the revolutionary experiments that emerged from a seminal design school, the Bauhaus (see p.126), and from artists and designers furthering the ideals of the Russian Revolution (see p.120). Along with photography, these conceptual departures founded radical approaches in the way information was communicated and design was practiced.

In the United States, on the other hand, there was a growing appreciation of design's potential to maximize profits. The streamlined aesthetic, applied to domestic products such as meat slicers as much as automobiles, was an early example of design as "styling." This period also saw the emergence of new design disciplines—graphic design, industrial design, and interior design, for example—along with a rise in designers' visibility; Raymond Loewy (1893–1986), one of the first showmen of design, and Russel Wright (1904–76) are cases in point. So, too, was automobile designer Harley J. Earl (1893–1969), head of General Motors' Styling Division, who ushered in the "Annual Model Change," where consumers were persuaded to trade in their old models due to changes in appearance alone. They made no secret of their motivation; nothing, said Loewy, was as beautiful as "an upwardly rising sales curve."

But it wasn't always about profit. Serving the greater good has long been an aim of many designers. In the immediate prewar years, design gained

▼ An armchair (*c.* 1934) in the streamlined style, made from chromium-plated steel, wood, and leather by the German furniture and industrial designer, architect, art director, and teacher Kem Weber (1889–1963). It is one of his iconic designs.

prominence in the public realm (see p.200) through exercises in corporate identity, such as London Transport's ambitious program in the early 1930s to integrate signage, station design, and route maps, or *The Book of PTT*, created by Piet Zwart (1885–1977) for the Dutch telegraph and telephone service. This was the era, too, of mass-market "people's cars," such as the Volkswagen Beetle.

World War II (see p.212) saw design pressed into a very different kind of public service—armaments, fighter aircraft, and tanks also require design input. Like the American Civil War, generally considered to be the first "modern" conflict, World War II provided a fast track to innovation across a broad range of disciplines, including materials technology. Developments such as radar and the jet engine came to fruition in the war's aftermath.

For shattered postwar economies, especially those on the losing side, design was to prove a means of both revitalizing production and establishing distinct national identities in a new world order. From this period dates Japan's emergence as a major exporter of goods manufactured under the stringent application of "quality control." In Italy, where design was seen as an indivisible part of *la dolce vita*, aesthetics combined with technical innovation created products desirable the world over. Germany's economic miracle rested on

► Rationalist principles clearly inform the look of this Braun television set (1957), designed in association with the Academy of Design at Ulm, Germany. Its form is dictated by its function, and no part of it is extraneous to that consideration.

▲ US designer George Nelson conceived the Comprehensive Storage System with Desk in 1958, and the Herman Miller Furniture Company manufactured it in 1960 from rosewood, plastic, metal, and glass. By the mid twentieth century, flexibility of use was established as an important design criterion.

a strictly rationalist foundation, promoted by the Hochschule für Gestaltung (see p.266) in Ulm, which served as a second Bauhaus. Closely allied was a purist, virtuously neutral Swiss approach to design, best characterized by the twentieth century's most successful typeface, Helvetica (see p.276).

On the domestic front, Scandinavian design was a surprise international hit in the postwar period: ceramics, glassware, furniture, lighting, and textiles produced in Denmark, Sweden, and Finland displayed a marriage of a modernist sensibility with natural materials and organic forms. Similarly, mid-century modern US designers such as Charles Eames (1907–1978) and his wife Ray (1912–1988), George Nelson (1908–86), Isamu Noguchi (1904–88), and Eero Saarinen (1910–61), promoted by progressive manufacturers such as Knoll and Hermann Miller, shared a forward-looking aesthetic, reflecting an optimistic faith in the power of science and technology to deliver lasting material progress. During this period, new materials, such as plastic, introduced a new disposability to the marketplace. At the same time, planned obsolescence became a commercial strategy to maintain production volumes.

As the twentieth century progressed, design became ever more mainstream, not merely for an enlightened trendsetting few, but deeply embedded in the contemporary lifestyle. Design became increasingly responsive to, and reflective of, changes in fashion and popular culture, from pop (see p.364) and psychedelia (see p.380) to punk (see p.410) and

► "This Mortal Coil" (1993) is an innovative bookcase consisting of a single strip of mild steel formed into a spiral by British artist Ron Arad (b.1951). The steel dividers are hinged at both ends so that the coil may be partly collapsed and reduced in size for transportation.

postmodernism (see p.416). Parallel to the counter-culture movements of the late 1960s, radical "anti-design" groups sprang up, such as Archizoom, challenging the notions of "good taste"; also, the oil crisis of the early 1970s raised the price of plastics, provoking a reevaluation of the throwaway society.

To a greater extent than ever before, design took up permanent residence on the high street. Pioneering retailers, such as Terence Conran (b.1931), founder of Habitat, and Ingvar Kamprad (b.1926), founder of IKEA, brought good design to the ordinary consumer. Design was implicit not only in products created by named designers, but also in time-honored classics, such as bright enameled homewares or flatweave Indian rugs: "designs without designers."

Design was also increasingly a form of celebrity branding. From the "designer decades" of the 1980s and 1990s, when profiles of designers soared into the stratosphere, design became the means to create objects of desire, status symbols for knowledgeable consumers well versed in the language of things. Minimalist, maximalist, high tech, and retro: styles came and went as design was drawn into the fashion cycle. In today's uncertain world of fragile economies and threatened resources, the scope and role of design has continued to evolve. Concerns such as fair trade, inclusivity, and sustainability add new ethical dimensions to design practice. Designers today have to consider not only how their products will be sold and used, but also how their manufacture and eventual disposal will affect the planet and its future.

Yet nothing has had such a profound impact on design's reach across the globe, and the speed with which it connects with its audience, than the arrival

of the digital age. This momentous technological revolution, which has given us apps, desktop publishing, computer-aided design, 3D printing, and rapid prototyping, among countless other innovations, has both transformed design practice and given rise to new typologies. For a generation arriving at adulthood today, life before the Internet is virtually unthinkable. Design has always been hard to define, and no more so than today when artificial intelligence is poised to reshape the way we live, work, and play.

Design: The Whole Story takes a close look at the key developments, movements, and practitioners of design around the world, from the beginnings of industrial manufacturing to the present day. Organized chronologically, the book locates design within its technological, cultural, economic, aesthetic, and theoretical contexts. From the high-minded moralists of the nineteenth century to the radical thinkers of modernism—and from showmen such as Loewy in the 1930s to today's superstars such as Philippe Starck (b.1949)—the book provides in-depth coverage of a subject that touches all our lives.

Iconic works that mark significant steps forward or that characterize a particular era or approach are analyzed in detail—such as Breuer's Wassily chair (1925; see p.136); corporate identity work by Eliot Noyes (1910–77) for IBM (1950s; see p. 400); and the Verdana typeface (see p. 478), designed to be read on screen, by Matthew Carter (b.1937).

Throughout the history of design, a fundamental tension between stylistic expressiveness and reductionism, between function and form, has been played out time and time again. But design is not simply a vehicle that records shifts in taste. As a way of imagining, it both defines and anticipates our needs, and as such is expressive both of commerce and culture. Intimately bound up with technology, it provides aesthetic solutions in material form. We are all consumers of design, from the automobiles we drive and the products we buy to the graphics that surround us. *Design: The Whole Story* provides all the information we need to decode the material world.

▼ Industrial designer Samuel N. Bernier used computer-aided design and 3D printing to create customized lids that clip onto empty cans, jars, and bottles to give them new uses. Among the upcycled objects below are a citrus juicer, a rain catcher, a paintbrush cleaner, a piggy bank, a lamp, a bird feeder, a long pasta container, an hourglass, a mug, and a dumbbell. The work is an aspect of Project RE_, which examines how communities might take on their own manufacturing.

1 | The Emergence of Design 1700–1905

INDUSTRIAL REVOLUTION

1

2

3

1 Isambard Kingdom Brunel revolutionized engineering with structures like his Clifton Suspension Bridge (1864) in Bristol, England.

2 Richard Trevithick's passenger-carrying steam carriage made its first journey in 1801 in Cornwall, England.

3 Harrison's Improved Power Loom (1851) was exhibited at the Great Exhibition in London and helped lay the foundation for modern textile mills.

The Enlightenment, or Age of Reason, effected a general shift in social ideals, which was followed by even greater social, political, and economic changes that arose from developments in technology, science, and culture. The period is now collectively termed the Industrial Revolution. Scientific advances and technological innovations improved agricultural and industrial production, eliciting economic expansion and changes in many people's living conditions and working lives. Beginning in England, these developments assisted the growth of national wealth and prosperity for some, while a population surge generated increasing demand.

The Industrial Revolution is usually described as occurring between approximately 1760 and 1840, although there was no sudden transformation. Improved agriculture, industry, and shipping led to an increase in the production of almost everything required by consumers, and the resulting dynamism of the economy transferred from agriculture to industry and trade. Industrialization marked a shift from individual, handmade production to powered, special-purpose machinery, factories, and mass production. The cumulative effect of a number of consequential inventions and designs made this possible. One of several crucial entrepreneurs was the manufacturer Richard Arkwright (1732–92), who created the first water-powered cotton mill, combining skills, machinery, and materials into what became the factory system. He also developed horse power and then water power, which made

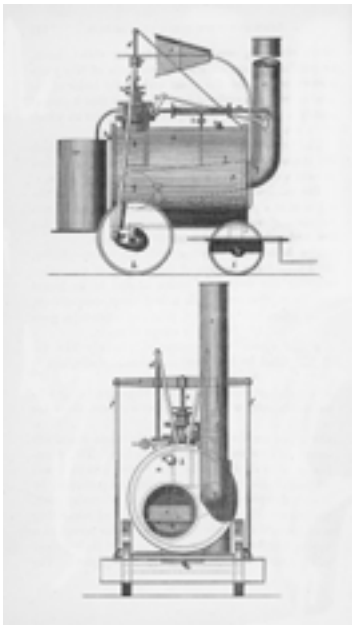
KEY EVENTS

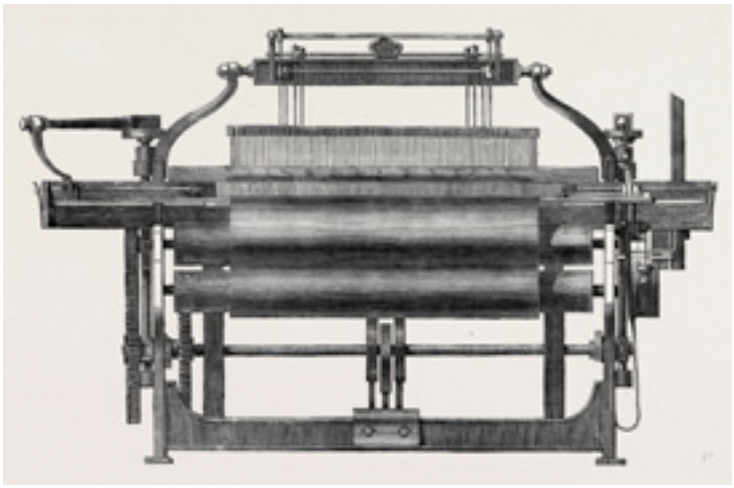
1709	1712	1733	1740	1751	1759
Abraham Darby (1678–1717) uses coke to smelt iron ore, replacing wood and charcoal as fuel initiating the mass production of cast iron.	Thomas Newcomen builds the first commercially successful steam engine to pump water out of mines.	John Kay (1704–c. 79) invents the flying shuttle that changes the weaving industry and revolutionizes textile production.	Crucible steel making is discovered by English clockmaker Benjamin Huntsman (1704–76).	English landscape gardener Lancelot "Capability" Brown (1716–83) sets up as an 'improver of grounds."	The first Canal Act is passed by the British Parliament, leading to the construction of a network of waterways for transport and industrial supplies.

cotton manufacture a mechanized industry. Further significant inventions included the power loom (see image 3), developed in the 1780s by Edmund Cartwright (1743–1823), that mechanized the process of weaving cloth.

Momentous achievements also occurred in the field of engineering. The use of fossil fuel was increasingly exploited and mining became more important, but as mines became deeper, many flooded and hand pumps were inefficient. In 1769 James Watt (1736–1819; see p.20) made improvements to an engine designed by Thomas Newcomen (1664–1729) that was intended to pump water out of mines by enabling the replacement of water power by steam. In the early 19th century, engineer Richard Trevithick (1771–1833; see image 2) constructed the first steam train. Iron and steel became essential materials, used to make everything from tools and machines to ships and building infrastructure. One of the most inventive engineers of the 19th century, Isambard Kingdom Brunel (1806–59), designed dockyards, railways, steamships, tunnels, and bridges. He implemented major improvements to docks, and became chief engineer to the Great Western Railway, introducing the broad-gauge railway track that made trains safer and faster because of increased stability. In 1864, five years after his death, Brunel's iron Clifton Suspension Bridge (see image 1) opened. It spanned a gorge in Bristol, south-west England, and was a feat of mankind, only possible through his ingenuity and technological advancements.

Industrial expansion continued to proliferate into the late 19th century, as the work of the early pioneers was followed by new inventions, discoveries, and ideas. As industrialization spread across Europe and the United States, people increasingly addressed questions of industrial design. **SH**





1764

English weaver James Hargreaves (*c.* 1720–78) invents the spinning jenny that enables workers to produce multiple spools of thread simultaneously.

1769

James Watt patents his improved steam engine as an industrial power source.

1779

The spinning mule, which makes it possible to produce fine yarns by machine, is developed by English inventor Samuel Crompton (1753–1827).

1793

US inventor Eli Whitney (1765–1825; see p.22) invents the cotton gin, solving the problem of supplying cotton speedily for the textile industry.

1802

English chemist William Cruickshank (d.1810/11) designs the first electric battery capable of mass production.

1856

Englishman Henry Bessemer (1813–98) patents the first inexpensive industrial process for mass producing steel.

Single-action Steam Engine 1763–75

JAMES WATT 1736–1819

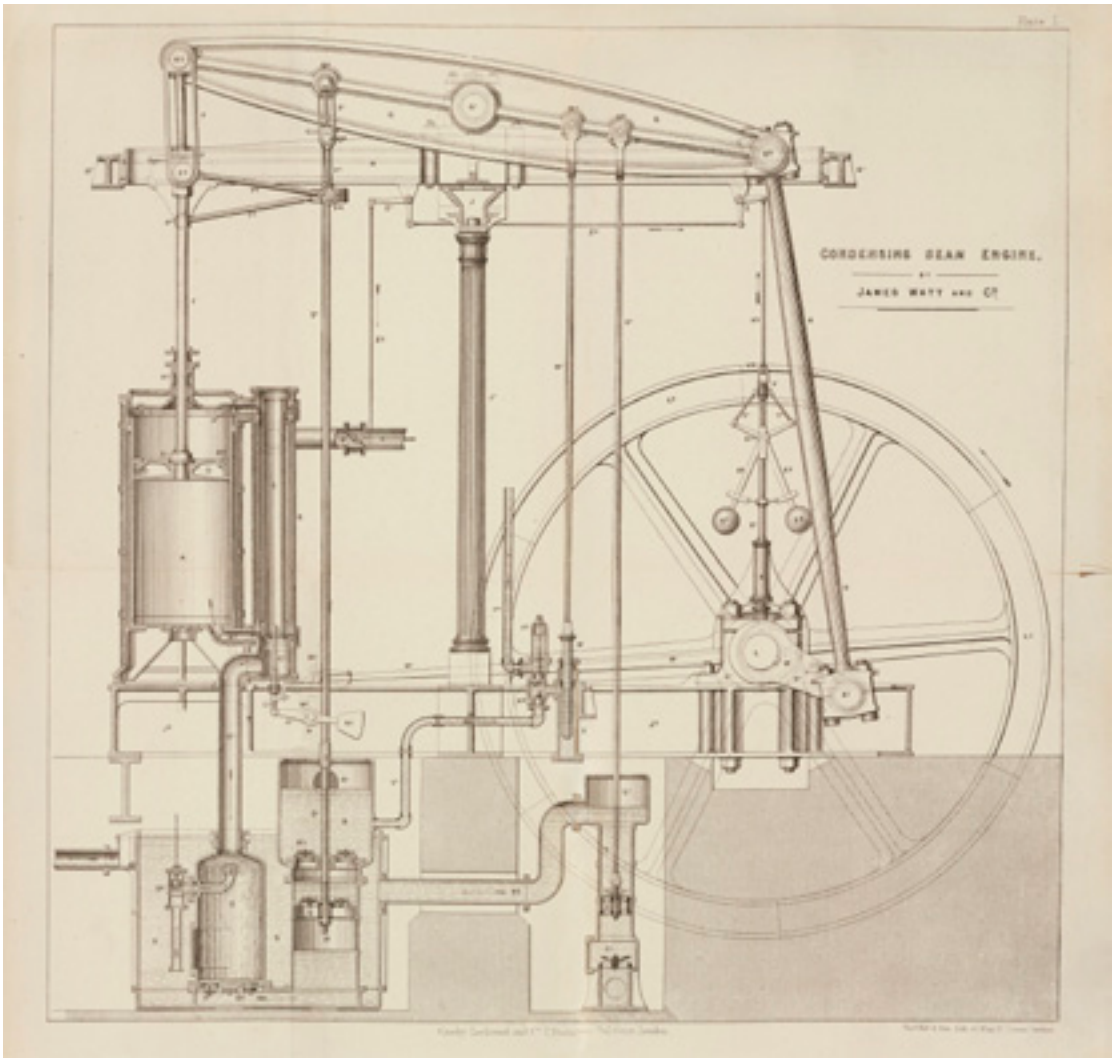
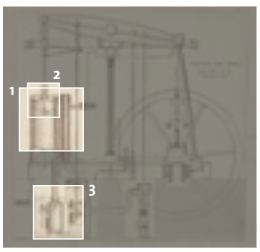


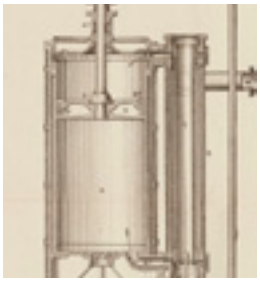
Plate from *Stationary engine driving: a practical manual* (1881) by Michael Reynolds

NAVIGATOR

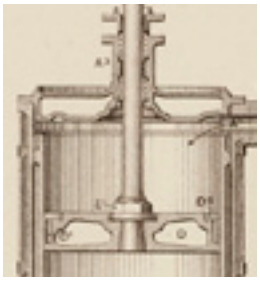


In 1698 the first commercially used steam-powered engine was built by English engineer Thomas Savery (*c*. 1650–1715). Designed to pump water out of coal mines, Savery's invention, consisting of a simple boiler and a pipe, had several problems. In 1712 his partner, Thomas Newcomen, improved Savery's steam pump with his atmospheric engine, which also deployed steam power. Also intended to pump water out of mines, Newcomen engines were fairly complex and were never cost effective. In 1763, while repairing a Newcomen engine, Scottish instrument maker James Watt decided to improve the design. Watt solved the problems of the Newcomen engine by creating a separate condenser outside the cylinder. Watt still had obstacles to surmount in constructing a full-scale engine, including a lack of capital and insufficient technology to make the parts. He formed a partnership with the manufacturer Matthew Boulton (1728–1809). Through Boulton, Watt had access to some of the best ironworkers in the world and gained the means to mass-produce his engines. As a direct result of the invention, the Industrial Revolution was irrevocably activated. **SH**

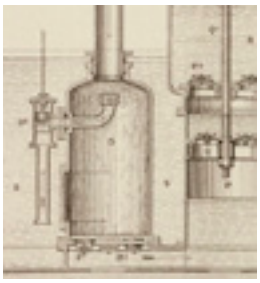
FOCAL POINTS



1 CYLINDER
Watt's steam cylinder was constantly hot; there was no enforced cooling required. The shell around the main cylinder helps to keep it hot. The steam cylinder operates on the downward stroke of the steam piston. The weight of the pump side tips the beam so that the steam piston rises.



2 PISTON
The engine operated on the principle of a pressure difference created by a vacuum on one side of the piston, which pushed it down. The top of the steam cylinder is sealed. During the upward and downward strokes at atmospheric pressure, steam exists above the piston.



3 CONDENSER
Watt's innovations included a separate condenser. Valves enabled the steam to flow into a separate condenser. When the condenser is under a vacuum, the steam from below the piston then rushes into it. The steam then condenses, and so the vacuum is maintained.

DESIGNER PROFILE

1736–73
James Watt was born in Greenock, Scotland. He trained as an instrument maker in Glasgow and London. From 1756, he worked as an instrument maker at the University of Glasgow. In 1763 a professor from the university gave Watt a Newcomen engine to repair. Within two years, Watt analysed how to improve it. A patent for his steam engine was granted in 1769.

1774–87
Watt moved to Birmingham. From 1776 to 1781 he spent time in Cornwall, installing engines in copper and tin mines. Next, he adapted his engines to be used to power machines in factories. Watt created a rotary motion in his machines, and in 1782 he invented the double-action steam engine. In 1784, he invented the parallel motion.

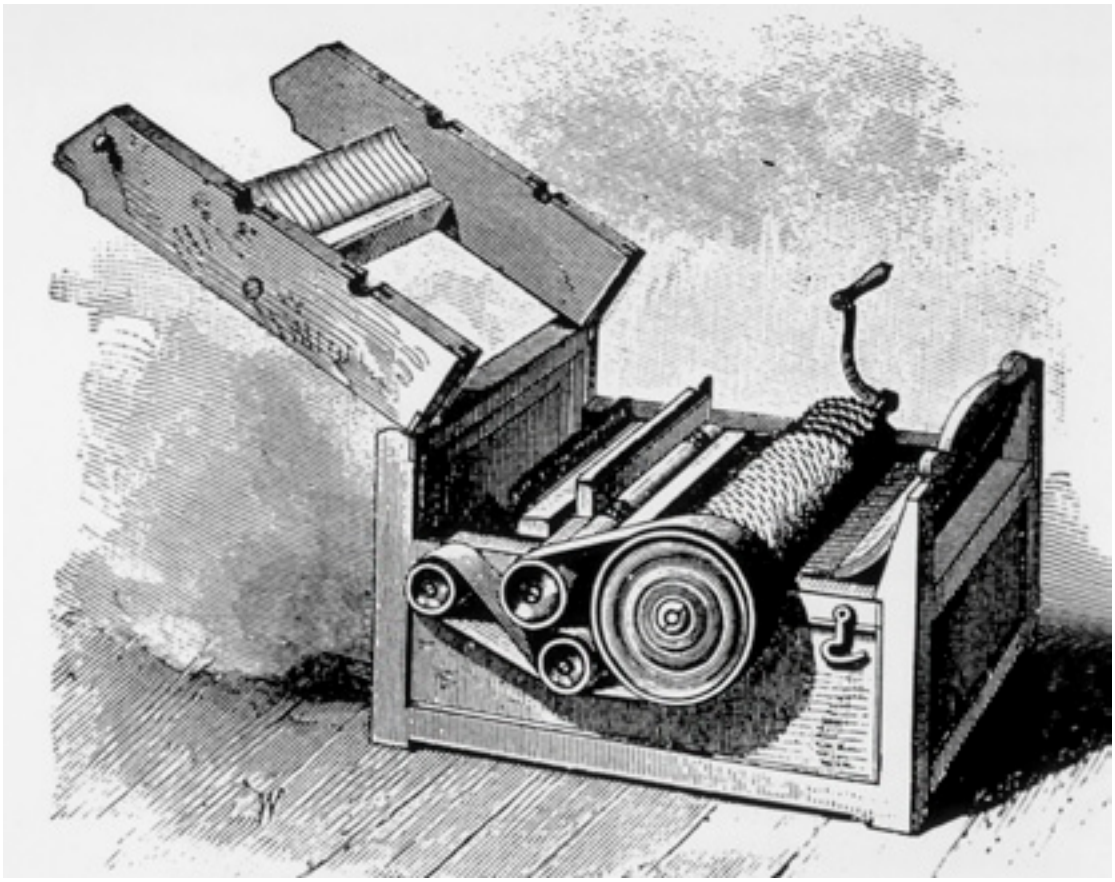
1788–1819
Watt invented the centrifugal governor to regulate steam engine speed and in 1790 the pressure gauge. He retired in 1800 and devoted his remaining years to research.

EFFICIENCY AND ECONOMY

The separate condenser was Watt's most significant invention with regards to his steam engine. On each stroke of a Newcomen atmospheric engine, the cylinder was heated by steam and subsequently cooled by cold water so that the steam condensed to water, which created a vacuum, forcing the atmosphere to push the piston down. By making the condensing process occur in a separate vessel, Watt ensured that the cylinder remained hot, which greatly increased the engine's efficiency and so improved economy. It took eleven years from his initial design for his first successful steam engine to be constructed, because the main problem had been the lack of technology to create a piston large enough to preserve a moderate amount of vacuum. Eventually, when technology caught up and Watt had secured financial support, he made his engine available to all. It was immediately used in transport, manufacturing, mining, and more. Watt's faster, more fuel-efficient engine was hugely successful and changed the world.

Cotton Gin 1793

ELI WHITNEY 1765–1825



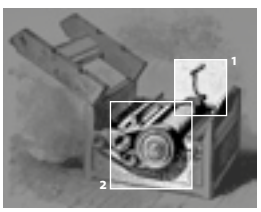
Lithograph from 1793 of the original cotton gin.

One of the first great inventions of the Industrial Revolution in the United States was the cotton gin (short for cotton engine), invented by Eli Whitney. This simple machine revolutionized the production of cotton by accelerating the process of removing seeds from cotton fiber.

Inferior versions of the cotton gin had existed since the 1st century AD, but Whitney's invention was the first practical machine. Before Whitney's cotton gin, separating cotton fibers from its seeds was a labor-intensive and unprofitable task undertaken manually—an average cotton picker could remove the seeds from approximately 1 pound (450 g) of short-staple cotton in a day. The cotton gin removed cotton fiber from its seeds. Cotton was run through a wooden drum embedded with a series of hooks that catch the fibers and pull them through a mesh. Although the mesh is too fine for the seeds to pass through, the hooks pull the fine cotton fibers through with ease.

Through the reduction of processing time, cotton became the United States' leading export by the mid 19th century. Whitney's cotton gin revolutionized the cotton industry, saving labor, enabling huge expansion, and reducing the prices of cotton simultaneously. Yet despite the cotton gin's success, it made little money for Whitney due to technicalities in patent laws. It was difficult for him to protect his rights, and even though the laws were changed a few years later, his patent expired before he realized much profit. Another negative factor was that cotton farmers increasingly called on slave labor to work the machines, even though elsewhere increasing numbers supported its abolition. **SH**

NAVIGATOR



FOCAL POINTS

1 HAND CRANK
With Whitney's hand-cranked cotton gin, one worker could remove the seeds from 50 pounds (22.5 kg) of short-staple cotton in a day, some fifty times more than the average cotton picker could do by hand. Larger cotton gins could be powered by horses and, later, by steam engines.

2 CYLINDER
The cotton gin was a relatively simple machine. Raw cotton was fed into a revolving cylinder via a hopper, short wire hooks pulled the cotton fiber through mesh and dropped it into a pile, while the seeds were deposited separately, ready to be planted next season.

◄ Whitney's cotton gin caused the cotton industry to expand vastly and greatly transformed the US economy. Because of the invention, the yield of raw cotton doubled every decade after 1800. The cotton gin boosted the textile industry, but an accompanying increase in the use of slave labor contributed to the outbreak of the American Civil War (1861–65). By the mid 19th century, the United States was growing 75 per cent of the world's entire cotton supply.

PROFIT-REDUCING PIRACY

Whitney made and repaired machines to support himself through Yale University. On graduating in 1792, he planned to teach while studying law. He travelled to Savannah, Georgia, where he met plantation owner Catherine Greene (1755–1814). Whitney accepted an invitation to stay at her plantation, Mulberry Grove, in Georgia. She and her plantation manager, Phineas Miller (1764–1803), showed Whitney the difficulties cotton farmers experienced in separating seeds from fibers to make cotton usable and gave him the use of a workshop where he created the cotton gin. Whitney received a patent for his invention in 1794 and formed a company with Miller. They planned to build and install cotton gins on plantations throughout the southern states of the United States, being paid a percentage of the cotton produced on each plantation. However, although farmers welcomed the new machine, they had no intention of sharing their expanding profits, and most pirated Whitney's design.

CLASSICAL REVIVAL

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3

1 Made from mahogany and oak with marquetry in satinwood and rosewood, the Kimbolton Cabinet (1771–76) was designed by Robert Adam for Kimbolton Castle in Cambridgeshire, England.

2 Thomas Chippendale completed this gilded beechwood and walnut armchair in 1765 for Robert Adam to satisfy a commission for a grand salon in a great London house.

3 Classical inspiration is evident in this amphora-shaped jasperware Wedgwood vase made *c.* 1790 at the Etruria pottery in Staffordshire, England. Round the middle are figures of Apollo and the nine Muses.

In the second half of the 18th century, the Industrial Revolution initiated an important period in the history of design. Mass production and mass consumption became possible through the development of new technologies, the introduction of large factories, and changes in urban living, resulting in a consumer revolution in which a new and diverse assortment of goods were available to a more disparate section of the population. The surge of important inventions stimulated a feeling of confidence, sense of progress, and interest in design. Machine-made objects had to be consciously planned; too many were produced to be able to rely on chance or for discrepancies to be practical. So the role of the designer changed. Conceptual work became an essential aspect of machine-made designs.

The custom for young, affluent Europeans and North Americans to go on a Grand Tour of Europe had developed over many years, and by the late 18th century it had become hugely influential on design and taste. The Grand Tour helped to define Rome as the cultural center of the Western world and

KEY EVENTS

1755	1757	1762	1764	1768	1769
German scholar Johann Winckelmann (1717–68) publishes *Thoughts on the Imitation of Greek Works in Painting and the Art of Sculpture.*	Robert Adam returns to Britain after three years in Rome, and amalgamates classical themes with his own ideas to form his Neoclassical style.	In Britain, Josiah Wedgwood is appointed royal supplier of dinnerware.	English weaver and carpenter James Hargreaves invents the spinning jenny, enabling weavers to work eight or more spools at once.	The Royal Academy is established in London, with Joshua Reynolds (1723–92) as its first president.	Scottish inventor and mechanical engineer James Watt (1736–1819) patents his steam engine with separate condenser.

expanded the appeal of classicism. Central figures of the classical revival that occurred at that time were three Scottish architects, the Adam brothers: John (1721–92), Robert (1728–92), and James (1732–94). After spending 1755 to 1757 in Rome during his Grand Tour, Robert designed exteriors and interiors, based on the classical styles he had studied, and established what became known as the "Adam Style." The Adam brothers believed in total design of their interiors, from windows to furniture, paintwork to fireplaces. Combining Neoclassical ornament with impeccable craftsmanship in furniture (see image 2) and grand pieces such as the Kimbolton cabinet (see image 1), Robert in particular led the classical revival in Britain, which then spread across Europe and North America.

Also inspired by Neoclassicism was the cabinetmaker and furniture designer Thomas Chippendale (1718–79). Additionally influenced by Chinese, Gothic, and French Rococo styles, he worked these diverse stylistic elements into harmonious and unified designs, capitalizing on the expansion of the middle classes who were demanding luxury goods. In 1754 Chippendale became the first cabinetmaker to publish a book of his designs: *The Gentleman and Cabinet-Maker's Director* (see p.26), which had an immediate and lasting international impact. Chippendale, Thomas Sheraton (1751–1806), and George Hepplewhite (1727–86) are often classed as the three most important English furniture makers of the 18th century. Sheraton's furniture is characterized by a feminine refinement of late Georgian styles, and Hepplewhite's furniture is light and elegant.

This atmosphere of expansion, intellectual and trade experimentation, and industrial progress was particularly prominent in Britain, and encouraged designers, industrialists, and inventors such as James Hargreaves (*c.* 1720–78), Matthew Boulton (1728–1809), Josiah Wedgwood (1730–95; see p.32), and Richard Arkwright (1732–92) to pursue new ideas and processes. In 1769 Wedgwood founded his Etruria pottery factory, where he produced ceramics inspired by ancient Greek and Roman pottery (see image 3). Aiming to serve the middle classes as well as the aristocracy, Wedgwood became a pioneer of the mass market; he was one of the first manufacturers to advertise in newspapers and to develop retail display. Continually experimenting with his designs and his manufacturing methods, he divided production into separate activities, which contrasted with handmade methods. Each of his factory workers specialized in a single activity, which increased overall output. It was the beginning of a production process that led to the car assembly lines of the early 20th century. The Etruria factory produced two categories of ceramics: "ornamental" and "useful." Both were made of earthenware, but the designs and finishes were different. To complete the ornamental designs, Wedgwood engaged some of the best artists of the day, including John Flaxman (1755–1826), George Stubbs (1724–1806), and Joseph Wright of Derby (1734–97). **SH**

1771

English entrepreneur Richard Arkwright founds the first water-powered cotton-spinning mill in Cromford, England.

1774

The first Shaker community sets up in the United States. The community becomes known for its furniture design and craftsmanship.

1775

Scottish watchmaker Alexander Cumming (1731/2–1814) is awarded the first patent for the flushing toilet (or valve closet).

1790

In the United States, Congress establishes a patent office to protect inventors and give them an incentive to develop new machines and methods.

1795

The first standardized graphite pencils are introduced—they are central to mechanical drawings used in the transition to an industrial culture.

1802

By passing a current through a thin strip of platinum, English chemist Humphry Davy (1778–1829) creates the first incandescent light.

The Gentleman and Cabinet-Maker's Director 1754

THOMAS CHIPPENDALE 1718–79

Plate showing tables from *The Gentleman and Cabinet-Maker's Director.*

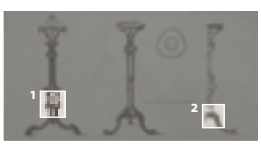
In 1753 Thomas Chippendale opened a furniture showroom in London's most fashionable shopping street of the time, St Martin's Lane. Profiting from the burgeoning, aspirational middle classes, Chippendale offered a wide range of high-quality furniture.

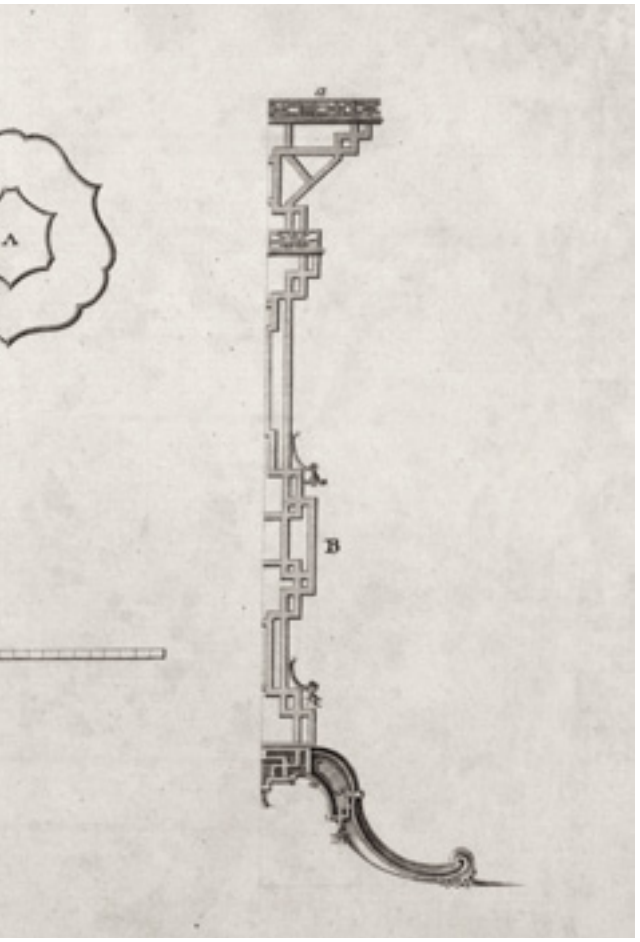
In 1754 he published an innovative catalog: *The Gentleman and Cabinet-Maker's Director*—a pattern book featuring 160 engravings of his designs. Although other furniture makers had produced catalogs before, none were as comprehensive or on such a large scale. The *Director* claimed to be "a large collection of the most elegant and useful designs of household furniture in the Gothic, Chinese and modern taste."

Published by subscription, Chippendale's *Director* was reissued in 1755 and again in 1762, when it included additional plates of his latest furniture in the new Neoclassical style. It was exceptionally successful. Subscribers included the rich and famous, including the actor David Garrick (1717–79), Catherine the Great (1729–96), and Louis XVI (1754–93), as well as the general public and other cabinetmakers.

Clients often used the *Director* as a guide and ordered simpler pieces for their homes, made with fewer elements or cheaper materials. They also combined elements they saw to create bespoke commissions. By publishing his designs in text and illustrations, Chippendale spread his influence far beyond the reaches of his London workshop. **SH**

NAVIGATOR





FOCAL POINTS

1 ENGRAVED ILLUSTRATIONS

Based on Chippendale's drawings, his friend, the publisher, draftsman and printmaker Matthew Darly (*c.* 1720–81), engraved most of the illustrations in the *Director*. The 160 plates show the variety of furniture and decorative objects that Chippendale's workshop could produce.

2 VARIETY

The 1754 and 1755 editions of the *Director* displayed furniture in four styles: English; French Rococo; Chinese, which emphasized the effects of chinoiserie, latticework, and lacquer; and Gothic, with pointed arches, quatrefoils, and fretwork. The 1762 edition included Neoclassical lines.

DESIGNER PROFILE

1718–61

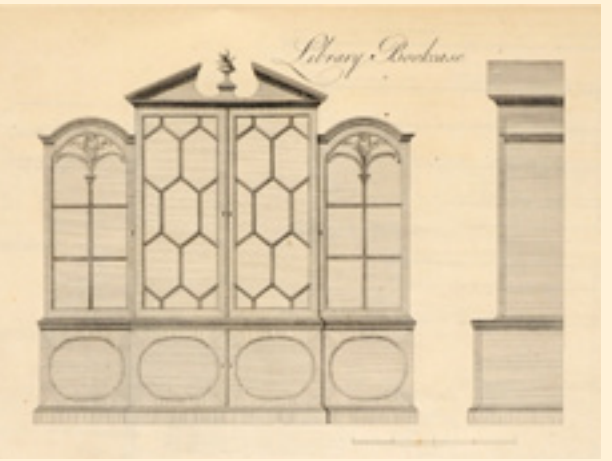
Thomas Chippendale was born in Yorkshire, England. He served an apprenticeship as a carpenter. He moved to London, where he had a showroom and workshop. In 1754 he published *The Gentleman and Cabinet-Maker's Director*. A second edition of the *Director* was published the following year.

1762–79

Chippendale created designs for a new *Director*, which was published in 1762. In 1776 he retired when his son, also Thomas (1749–1822), took over the firm.

MARKETING TOOL

By enlisting subscribers—buyers who prepaid for their copies of his finished book—Chippendale self-published the *Director*. It was a good marketing tool. Chippendale's business soared and he was soon employing approximately fifty skilled craftsmen to keep up with demand. Even though all the plates are signed by him, some of the designs were by other designers who worked for him. Many of the designs include instructions for less experienced cabinetmakers and options for making pieces more or less elaborate, to suit different skill levels or budgets. The patterns were influential across Europe and proved particularly popular in North America, where they were adapted to local materials and tastes.



THE CONCEPT OF TASTE

By the mid 18th century, the notion of taste had become an obsession. The idea of being able to discern between vulgarity and decorum—or to have good taste—became a measure of a person's worth, and the period saw an explosion in industries where good taste was essential, such as in Chippendale furniture (see p.26), Wedgwood pottery (see p.32), and Sèvres porcelain (see image 1). Designers sought to bring elegant lines and a lighter touch into people's lives. The focus on taste was linked to the prospering middle classes, who were enjoying the accoutrements of wealth, and it gauged old money against new. While many aristocrats disagreed, most realized a person could have taste even if he or she did not have breeding. Good taste became synonymous with etiquette, sophistication, and refinement.

Trade expansion and the Industrial Revolution generated the increase in consumption, which in turn prompted a rise in the number of designers producing goods, and inspired the extensive debates about taste. The flamboyant, dramatic Baroque style became replaced by two distinct design approaches. Rococo was whimsical and light hearted, inspired by the French court, while Neoclassicism rejected the asymmetrical frivolity of Rococo, and

KEY EVENTS

1704

English physicist Isaac Newton (1643–1727) publishes his discoveries and theories on light and color in *Opticks*.

1709

After years of research, German scientists discover how to manufacture Chinese-style hard-paste porcelain.

1710

The Saxon royal factory at Meissen, Germany, opens. It is the first to produce porcelain in Europe in large quantities and the recipe is kept secret.

1711

Anthony Ashley Cooper, 3rd Earl of Shaftesbury (1671–1713), equates bad taste with vice in his essays *Characteristics of Men, Manners, Opinions, Times*.

1718

English merchant Thomas Lombe (1685–1739) patents a silk thread throwing machine powered by a waterwheel.

1749

English furniture maker Thomas Chippendale (1718–79) opens his first workshop in London.

instead looked to the formality and symmetry of ancient Greece and Rome. On his Grand Tour, amateur architect Richard Boyle, 3rd Earl of Burlington and 4th Earl of Cork (1694–1753), became inspired by the Italian architect Andrea Palladio (1508–80), whose buildings were influenced by the mathematical precision of ancient Classical architecture. Burlington took many ideas he had seen in Palladio's architecture back to Britain and inspired a generation of architects. Palladio was heavily influenced by the writings of the Roman architect, Vitruvius (*c.* 80–70–*c.* 15 BC) who, in *The Ten Books of Architecture* (*c.* 15 BC), wrote that a building should meet "obligations of commodity, firmness, and delight." Commodity addresses how a building serves its function. Firmness means its ability to stand up to natural forces over time, and delight implies that it should look beautiful.

This provoked further discourse on art, beauty, and discernment, and in Germany, the philosopher Alexander Gottlieb Baumgarten (1714–62) gave the term "esthetics" a modern application, using it to mean good taste or a sense of beauty. He defined taste as the ability to judge intuitively rather than through intellectual consideration. Baumgarten's ideas were influenced by ideals of the Enlightenment, a European movement that lasted from the mid 17th century to the late 18th century, when new ideas about the use of reason were considered, a notion that had first been explored by philosophers of ancient Greece. It was during the Enlightenment that several public museums first opened in Europe, including the British Museum in 1759, the Uffizi in 1765, and the Louvre in 1793, which all added to collective sensibilities about taste, connoisseurship, and culture.

In 1757 the British statesman Edmund Burke (1729–97) published his influential philosophical treatise, *A Philosophical Enquiry into the Origin of Our Ideas on the Sublime and the Beautiful*, which concludes that esthetic abilities are improved through experience and knowledge. He argued for the uniformity of taste on the basis of sensibility rather than on judgement, explaining that taste is innate and not logical.

As well as being inspired by Palladianism, Neoclassicism was influenced by the excavations of Herculaneum and Pompeii. In 1738 and 1748 respectively, these two ancient Roman towns had been discovered intact, preserved beneath the ash of Mount Vesuvius, which had erupted in AD 79. The new interest in Classical ideas pervaded all areas of the decorative arts, emphasizing straight lines and geometric motifs, establishing the general belief that the Classical world was the epitome of elegance. While national interpretations varied, from the French Empire style to the Regency style in Britain, from the German Biedermeier style (see image 2) to the Gustavian style in Scandinavia, and the Federal style in the newly formed United States, the Neoclassical style generally engendered the consensus that good taste is discerned by an appreciation of restraint, quality, and harmony. **SH**

1

2

1 The exuberant shapes in this Sèvres porcelain coffee and tea service, completed in 1861, evoke the Near East and China, reflecting the contemporary French taste for exoticism.

2 This elegant side chair was made in 1820 by the firm of Viennese furniture maker Josef Ulrich Danhauser (1780–1829). Its simple forms and clean lines are characteristic of the Biedermeier style.

1757

Scottish philosopher David Hume (1711–76) publishes *Four Dissertations*. The essay collection considers taste and esthetics.

1760

The first exhibition of contemporary art in England is held by the Royal Society of Arts in London.

1769

English potter Josiah Wedgwood (1730–95) founds his pottery works at Etruria in Staffordshire, England.

1782

Wedgwood develops a pyrometer for measuring extreme heat in ovens, kilns, and furnaces.

***c.* 1785**

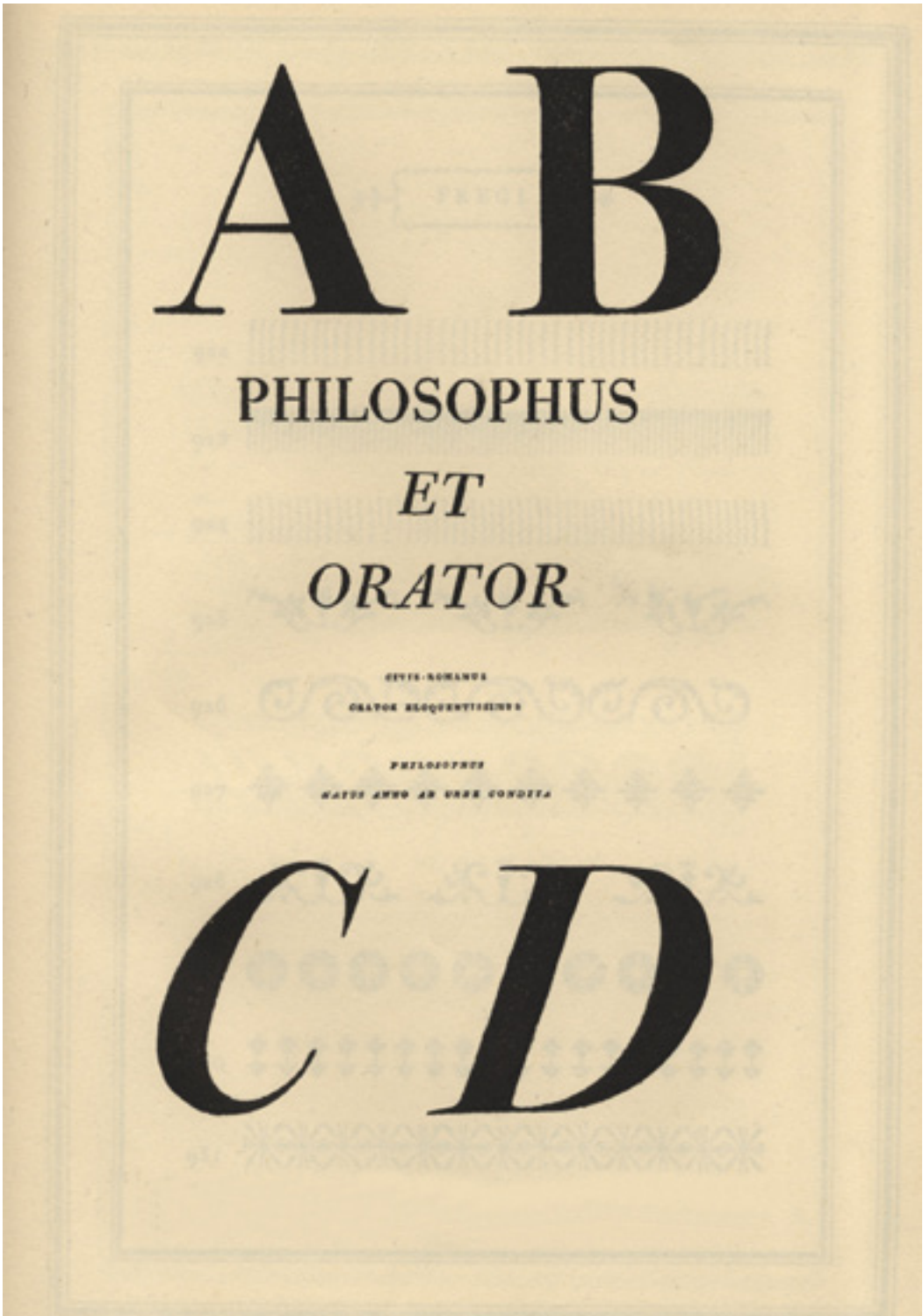
Italian printer and typographer Giambattista Bodoni (1740–1813; see p.30) designs the modern typeface, Bodoni.

1796

German actor and playwright Alois Senefelder (1771–1834) invents the printing technique of lithography.

Bodoni *c.* 1785

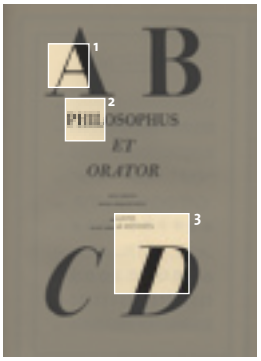
GIAMBATTISTA BODONI 1740–1813



NAVIGATOR

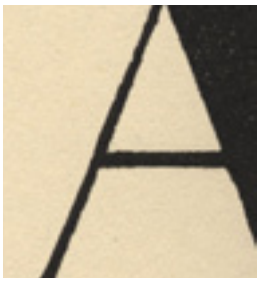
Since movable type was invented in *c.* 1439 by German printer Johannes Gutenberg (*c.* 1398–1468), countless typefaces have been designed, but only a few have endured to become classics that retain popularity for centuries. Bodoni is such an exemplary font. Designed by Italian publisher and typographer Giambattista Bodoni in *c.* 1785, it was inspired by the type designs of English printer John Baskerville (1706–75), and French printers Pierre-Simon Fournier (1712–68) and Firmin Didot (1764–1836).

At the time, book publishing focused attention on illustration, and typography's significance had diminished. Printers were using undistinguished typefaces and substandard printing inks. Printed type lacked clarity and definition, while technical limitations meant that inferior books were the norm. Determined to change this, Bodoni began by copying Fournier and Didot's typefaces. Fournier had first proposed a comprehensive point system in 1737, later adding refinements, and his ideas were perfected by Didot. Bodoni established his own foundry, and began designing a typeface that departed from the French designs and moved towards the Baskerville font he had admired for so long. Resolving to create a classic design, he designed the typeface that became synonymous with his name, characterized by simplicity and emphasizing straight, clean Neoclassical lines with bold, contrasting strokes and an overall geometric construction, reminiscent of ancient Roman inscriptions. **SH**

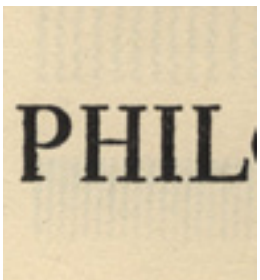


Roman and italic capitals in the Bodoni typeface designed by Giambattista Bodoni from his *Manual of Typography* (1818).

FOCAL POINTS

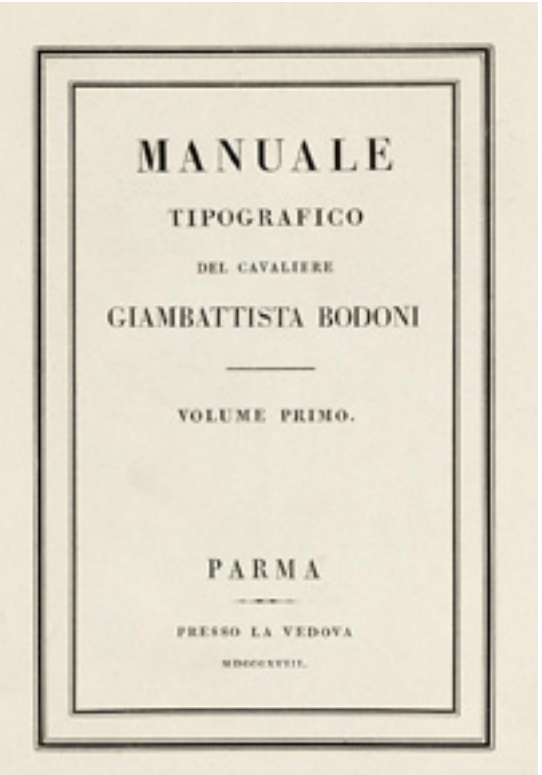


1 HAIRLINE STROKES
Picking up on the contemporary preference for classical styles, the Bodoni typeface features clear, simple lines and structure, with thin, hairline strokes. It was one of the first modern typefaces to exhibit extreme contrasts of light and dark in its thick and thin strokes.



2 VERTICAL STROKES
Bodoni is known as a "modern" typeface. Modern typefaces are distinguishable by their vertical emphasis and strong contrasts of vertical and horizontal strokes. Modern serifs and horizontals are extremely thin, almost hairlines. Bodoni's font is the most influential modern typeface.

3 UNBRACKETED SERIFS
The unbracketed serifs and balanced lines made Bodoni's font timeless and classical. From the end of the 18th century, when he first designed it, the Bodoni typeface inspired a number of other type designers to create new versions of it, particularly in the early 20th century.



▲ Bodoni evolved original typefaces, redefining letters by giving them a more mathematical, geometric, and mechanical appearance. His *Manuale tipografico* (*Manual of Typography*, 1818) discusses more than 300 typefaces, and shows how he used ideas from ancient Greek and Roman lettering and blended them with his concepts, resulting in the elegantly balanced font.

First Edition Copy of the Portland Vase *c.* 1790

JOSIAH WEDGWOOD 1730–95 JOHN FLAXMAN JR 1755–1826

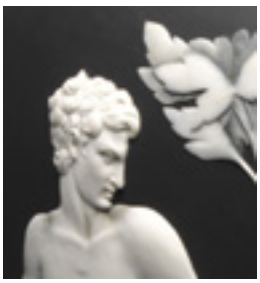
Jasperware, with black dip and white reliefs
Diameter 9⅞ in./25 cm

NAVIGATOR

Made of violet-blue layered glass with a white cameo relief, the Portland Vase dates from between AD *c.* 5 and AD 25. Found in a tomb near Rome in 1582, it was bought by Cardinal Francesco Barberini in 1627 and remained in his family until 1780. After being sold, it reached England and was bought by the Dowager Duchess of Portland in 1784. Two years later her son, the third Duke of Portland, acquired it and lent it to Josiah Wedgwood for a year. Josiah became obsessed with replicating the vase in his own delicate jasperware, a smooth, matt, fine-grained ceramic that he developed in the 1770s. Josiah, his second son, Josiah II, and John Flaxman Junior, a Neoclassical sculptor and designer, toiled to imitate the ancient vase for nearly four years.

In October 1789, Josiah sent the first successful copy of the vase to his friend Erasmus Darwin. The following May, he gave another copy to Queen Charlotte, and then organized a private viewing at the house of the president of the Royal Society, Joseph Banks. By May 1790, Josiah had received twenty subscriptions for the vase. These favorable reactions encouraged him to exhibit the vase abroad, and Josiah II took it around Europe for six months, which reinforced the Wedgwood company's reputation. **SH**

FOCAL POINTS



1 WHITE CAMEO
Although Josiah Wedgwood's modelers produced precise molds of the relief figures on the original vase, replicating the translucent white cameo proved difficult. He wrote to a friend: "My present difficulty is to give those beautiful shades to the thin and distant parts of the figures."

2 FIGURE
A leading figure in European Neoclassicism, John Flaxman Junior was employed by Wedgwood as a modeler. Wedgwood's trademark ancient Greek- and Roman-inspired designs were created mostly by him, and the creative challenges of the Portland Vase owe much to his skills.

EXPERIMENTATION

The Portland Vase (see right) copies are among the greatest of Josiah Wedgwood's achievements, but they took him nearly four years to perfect. After much experimentation, he used a black colured jasperware that he called "basalt ware." The first difficulties he experienced with the jasper body included cracking and blistering, and then lifting of the reliefs during firing. On the original vase, some layers of the cameo are cut thinly in places so that the white is tinted by the dark glass shining through. Initially, Wedgwood worried that his reliefs could never be applied thinly enough to replicate that delicacy, and on some first-edition vases, he achieved the effect by coloring the reliefs lightly with gray and brown shadows. In all, the vases were difficult to make and only about thirty were made between 1790 and his death in 1795, each offered for sale at thirty guineas each, plus £2 10 shillings for the box. After his death, no more Portland vases were manufactured by the Wedgwood company until 1839, when the copied ancient Roman figures were remodeled in consideration of Victorian prudery.

DESIGN REFORM

In 1835 and 1836 in Britain, a report by the Parliamentary Select Committee on Art and Manufactures expressed concern that greater encouragement was being given in France, Germany, and "other manufacturing countries" to "the art of design" and "correct principles of taste." In consequence, British-manufactured goods were lacking in style and risked losing the "export race." Over the rest of the century, the argument for better design rose to prominence among artists and manufacturers.

In 1837 the Government School of Design (later the Royal College of Art) was founded in London to improve the education of designers, but it faced a difficult task as industry continued to respond to the overly ornate styles favored by the public. The Industrial Revolution had created a burgeoning middle class who sought to furnish their new homes lavishly, and many manufacturers were churning out goods to capitalize on this. Most of these manufacturers viewed design as simply a part of production, not a separate consideration requiring specialist thought and planning.

Henry Cole (1808–82) was one of the first critics of this. He decided that if respected fine artists designed everyday objects, public taste would be improved. In 1845 the Society for the Encouragement of Arts, Manufactures and

KEY EVENTS

1810	1826	1829	1830	1832	1836
German printer and inventor Friedrich Koenig (1774–1833) patents a steam-driven printing press.	Scottish civil engineer, architect, and stonemason Thomas Telford (1757–1834) completes two suspension bridges in Wales.	English civil and mechanical engineer George Stephenson (1781–1848) builds his Rocket steam locomotive to compete in railway trials.	The Altes Museum in Berlin, designed by German architect Karl Friedrich Schinkel (1781–1841), is completed after seven years of construction.	English mathematician and inventor Charles Babbage (1791–1871) creates the first calculator, which he calls a "difference engine."	Augustus Pugin publishes his architectural manifesto, *Contrasts*, which argues for a revival of medieval Gothic architecture.

Commerce (later the Royal Society of Arts, or RSA) offered a prize for designs for a tea service. Using the pseudonym Felix Summerly, Cole produced a design executed by Minton (see image 1) that won a silver medal. He went on to establish Summerly's Art Manufacturers and commissioned several accomplished artists to design items to be industrially produced. Although short lived, his venture inspired further similar enterprises, which helped his objective of reforming design. Between 1847 and 1849, Cole also organized annual exhibitions for the RSA to promote a greater focus on good design, and in 1849 he founded *The Journal of Design and Manufactures*, edited by Richard Redgrave (1804–88), artist and principal of the Government School of Design. Cole noted that a large problem was that many manufacturers perceived design as an addition, to be added to an object at the end of manufacture, rather than an integral part of it from its conception. Ornamentation was frequently used to disguise inferior materials or poor-quality workmanship.

The poor standards of British design became apparent at the Great Exhibition (see p.38) in London in 1851. Cole, who had instigated the exhibition in the hope of elevating public taste, was particularly concerned. In 1852 he became General Superintendent of the new Department of Practical Art, which was set up to reform training in schools and colleges across the country. He, Redgrave, and the Crystal Palace's interior designer, architect Owen Jones (1809–74), developed guidelines for the study of design at the Government School of Design. Jones had traveled abroad and his attempts to create a modern style were inspired by the Islamic world (see image 2). The men aimed to raise standards, to avoid superfluous ornamentation, and to educate public taste away from the garish designs that dominated the market.

Despite featuring so many meretricious designs, the Great Exhibition was a success and generated a considerable profit. Part of this was used to acquire some of the displays to form a collection in a new Museum of Ornamental Art (later the Victoria and Albert Museum). One room in the museum displayed poorly designed objects, intended to shame the manufacturers who produced such monstrosities, and to educate the public about design. The room was labeled "Decorations on False Principles," but it became known as the "Chamber of Horrors." The museum's purchasing committee included Cole, Redgrave, and the architect, designer and critic Augustus Pugin (1812–52; see p.36). Pugin favored the medieval Gothic style, perceiving it as morally appropriate, and almost single-handedly established Gothic Revivalism as a dominant design style of 19th-century Britain, particularly in architecture.

Aligned with Pugin's medievalism, as well as Cole's and Redgrave's design concerns, the Arts and Crafts movement (see p.74) rejected modernity and industry. Founded by the textile designer, artist, and socialist William Morris (1834–96), the Arts and Crafts movement also followed the teachings of the highly respected art critic and theorist, John Ruskin (1819–1900). **SH**

1

2

1 Henry Cole's prize-winning earthenware and porcelain tea service was in production from 1846 to 1871.

2 Inspired by trips to Spain and Egypt, Owen Jones attempted to influence taste with his designs for tiles in Islamic style (*c.* 1840–50).

1837

English schoolmaster Rowland Hill (1795–1879) proposes the idea of the first adhesive prepaid postage stamp.

1840

Construction begins on the Palace of Westminster in London, designed by English architects Pugin and Charles Barry (1795–1860).

1849

The bowler hat is created by London hatters Lock and Co, for a customer who requires protective headwear for his gamekeepers.

1853

Inspired by the Great Exhibition held in London in 1851, the first US World's Fair opens in New York City at the Crystal Palace.

1854

In *Hard Times*, Charles Dickens (1812–70) caricatures Henry Cole as a government inspector who explains the principles of good taste to schoolchildren.

1856

Owen Jones publishes *The Grammar of Ornament*, illustrating patterns and designs from various decorative traditions.

Wallpaper for the House of Lords 1848

AUGUSTUS PUGIN 1812–52

FOCAL POINTS

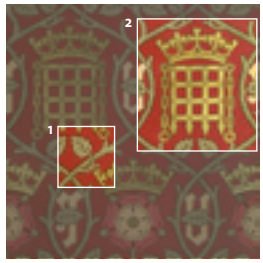
1 LEAVES

Flat patterns appeared on Pugin's wallpapers, replacing the excessively embellished designs that were popular. The colors are adaptations of medieval pigments. This design is composed of simple repeating forms that articulate the flatness of the wall rather than misrepresenting it.

2 PORTCULLIS

This wallpaper design incorporates the symbol of the Palace of Westminster, the crowned portcullis, and the Tudor rose, a royal emblem. The letters "V" and "R" stand for Victoria Regina, the reigning monarch, so the design symbolizes the authority of the crown and parliament.

NAVIGATOR



Body colors on red paper
23 x 21 in.
58.5 x 53.5 cm

Declaring in his 1836 manifesto, *Contrasts*, that design should move away from "the present decay of taste," Augustus Pugin focused on purity and clarity, initiating the idea of "honesty" and "propriety" in ornament and design. He insisted that only flat patterns should adorn flat surfaces, emphasizing rather than disguising them, and that false illusions of depth, texture, and three dimensions were dishonest and contrived. This became an essential principle of the design reform movement.

Aiming to reform and improve society by idealizing the medieval system, Pugin argued that good design had moral integrity, while bad design was insincere and deceitful. The Gothic Revival that he promoted was to him both ingenuous and Christian. Though he was brought up by his mother in the strict Scottish Presbyterian Church, he converted to Roman Catholicism, believing fervently that architecture with tall spires pointing heavenward, and candidly designed wallpapers, carpets, and furnishings followed the Catholic doctrine and would have a positive effect on society. In 1847 he visited Italy and subsequently incorporated some of the grandest Italian designs into his own. At the Great Exhibition of 1851 (see p.38), he designed a complete range of Gothic-style furnishings, many available to order at relatively modest prices. In their medieval setting, his simply styled tables and colorful dinner plates were new and fresh to contemporary eyes, and appealing to visitors at the Crystal Palace. **SH**

DESIGNER PROFILE

1812–26

Augustus Welby Northmore Pugin was born in London, the son of an architect. He attended Christ's Hospital school in London and his father taught him architectural drawing.

1827–35

Pugin was employed to design furniture for George IV at Windsor Castle. He began an antique furniture business and worked as a set designer at King's Theatre in London. He was briefly held in a debtors' prison when his furniture business collapsed. In 1835, he converted to Catholicism.

1836–43

He published *Contrasts*, his first architectural manifesto, and designed churches, cathedrals, houses, and a monastery. He became Barry's assistant on the new Palace of Westminster.

1844–52

His third book, *The Glossary of Ecclesiastical Ornament and Costume*, was published. He designed the interior decorations for the House of Lords, the Medieval Court for the Great Exhibition, and the clock tower at the Palace of Westminster. Suffering from exhaustion, he was committed to Bedlam and died soon after.

THE PALACE OF WESTMINSTER

After the huge fire of 1834, a competition was organized to find an architect to rebuild the Palace of Westminster in London. Pugin acted as draftsman for two of the ninety-seven entrants: Charles Barry (1795–1860) and James Gillespie Graham (1776–1855). As he was so instrumental in Barry's success, Barry asked Pugin to work with him. Construction of the Palace of Westminster began in 1840 and lasted for thirty years. Pugin's contribution can be seen in the distinctive Gothic details, including vanes and spires. He designed almost all the Gothic-style interiors, including more than one hundred wallpapers, carvings, stained glass, floor tiles, metalwork, furniture—and the clock tower that houses Big Ben. Pugin's ideas had a powerful effect on the design reform movement. His belief that even "the smallest detail should have a meaning or serve a purpose," and his principles of historical authenticity in design and reduced ornamentation, had a dramatic effect on designers and the public.

THE GREAT EXHIBITION

The first in a series of world fairs, the Great Exhibition was devised by Henry Cole (1808–82), an English civil servant. Through his membership of the Society for the Encouragement of Arts, Manufactures and Commerce, Cole campaigned to improve standards in industrial design. Prince Albert (1819–61), Queen Victoria's husband and the society's president, supported his ideas, and in 1847 a royal charter was granted to the organization. In 1849 Cole visited the Exposition Nationale des Produits de l'Industrie Agricole et Manufacturière (Exposition of the Second Republic) in Paris and noticed there was no opportunity for international exhibitors. On his return to England, he secured a Royal Commission for an international exhibition to be held in London.

Led by Prince Albert, the society planned the Great Exhibition of the Industry of all Nations. Held from 1 May to 15 October 1851 in London's Hyde Park, the exhibition attracted more than six million visitors and featured over 100,000 exhibits by more than 15,000 contributors. The range of displays was vast, from the overly ornate to the purely functional, from household goods to industrial machines, from quality merchandise to poorly made products. It was the first time that the nations of the world had come together in one place in peace, and it was a showcase for the manufacturers of Britain and the world,

KEY EVENTS

1815	1822	1825	1831	1834	1839
English chemist Humphry Davy (1778–1829) invents the miner's safety lamp, which shields the naked flame to prevent explosions in mines.	French Egyptologist Jean-François Champollion (1790–1832) deciphers ancient Egyptian hieroglyphs using the Rosetta Stone.	Biedermeier furniture, inspired by French Empire style but in light woods that avoid metal ornamentation, becomes popular in Europe.	American farmer Cyrus McCormick (1809–84) invents the mechanical reaper-harvester that frees farm laborers to work in factories.	In London a fire destroys most of the Palace of Westminster and both Houses of Parliament.	Photography is commercially introduced, perfected by William Henry Fox Talbot (1800–77).

a pivotal moment for the development of design in the 19th century. More than forty different countries were represented, but as the host nation, British displays (see image 1) took up half the exhibiting space. Exhibits varied from a hydraulic press invented by civil engineer Robert Stevenson (1772–1850) to a fountain made of four tons of pink glass and a steam hammer that could, with equal accuracy, forge the main bearing of a steamship or gently crack an egg, as well as carpets, cups, chairs, printing presses, and agricultural machines (see image 2). Although the fundamental purpose of the exhibition was the promotion of world peace, the repeating firearms of Samuel Colt (1814–62; see p.48) featured prominently. There were examples of every kind of machine, including a sewing machine by Isaac Merritt Singer (1811–75; see p.40). There was a huge variety of ornamentation, patterns, and historical style references, and the chaotic lack of accord was criticized from all sides.

The exhibition was not only a venue for international competition, but also became an arena that demonstrated national differences. Diversities in attitudes to design across Europe and the United States became immediately apparent. Overall, despite the Industrial Revolution, most Europeans still appreciated the virtues of hand craftsmanship—of embellishment over function. Americans, however, preferred mass production as a means to achieve better-made, simply designed objects in greater numbers. For critics of the day, the contrast between overly ornate household products and those displaying either an unembellished functional esthetic, or those revealing an instinctive connection between hand and eye, established the urgent need for design reform, education, and accord. **SH**

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2

1 A lithograph commissioned by Queen Victoria and Prince Albert depicting the British nave at the Great Exhibition, published by Dickinson Brothers in *Dickinson's Comprehensive Pictures of the Great Exhibition of 1851* (1854).

2 A photograph of various agricultural implements, including a steam traction engine and two types of seed drill, manufactured by Garrett and Sons and shown at the Great Exhibition in 1851.

1848

The Pre-Raphaelite Brotherhood is founded by a group of British artists. It aims to promote art about serious subjects treated with realism.

1849

French gardener Joseph Monier (1823–1906) invents reinforced concrete to use for horticultural tubs and containers.

1854

At the New York World's Fair, Elisha Otis (1811–61) demonstrates his safety elevator, or lift, by cutting the rope holding the platform on which he is standing.

1855

The Christmas edition of the *Illustrated London News* features chromolithographs, becoming the first colored newspaper.

1856

English chemist William Henry Perkin (1838–1907) accidentally produces the first synthetic dye – aniline purple or mauveine.

1869

The Suez Canal is opened in front of thousands of spectators in Egypt. It connects the Mediterranean Sea with the Red Sea.

Sewing Machine 1851

ISAAC MERRITT SINGER 1811–75

FOCAL POINTS

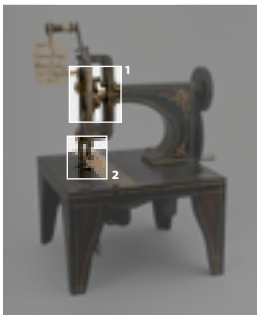
1 TREADLE

Singer's needle moves up and down rather than side to side, and is powered by a foot treadle (not shown), which allowed an unprecedented speed of 900 stitches per minute. The features of his basic machine are evident in the design of later machines by other manufacturers.

2 NEEDLE

Singer's sewing machine was the first to incorporate features that allowed continuous and curved stitching on any part of an item being made. It has a suspended arm holding a straight needle in a horizontal bar. The design helped to reduce thread breakage.

NAVIGATOR



Metal overall, iron mechanisms
16 x 17 x 12 in.
40.5 x 43 x 30.5 cm

The US inventor and entrepreneur Isaac Merritt Singer did not invent the sewing machine, but in 1851 he patented the first practical and efficient one. Semi-literate Singer had been taking acting jobs when possible, with odd jobs in between, when he began working in a machine-repair shop in Boston. In 1850 he was given a sewing machine to repair and eleven days later he had made a better one, which he patented the following year—after exhibiting it at the Great Exhibition in London. The same year he set up I. M. Singer and Company, later renamed the Singer Manufacturing Company. However, the eye-pointed needle and lockstitch that Singer incorporated had already been developed and patented by Elias Howe (1819–67), and in 1854, Howe won a patent-infringement suit against him, but Singer carried on making his machines.

Until then, sewing machines had been industrial machines, but from 1856 Singer began marketing smaller machines for home use. Singer used the latest mass-production techniques to produce large numbers of machines at economically viable prices. By 1855 his company had become the largest producer of sewing machines in the world, and by 1863 the Singer Manufacturing Company had secured twenty-two further patents for improvements to his machine. In 1867 the company opened its first factory outside of the United States, in Glasgow, Scotland. **SH**

DESIGNER PROFILE

1811–48

Isaac Merritt Singer was born in Pittstown, New York, the eighth child of German immigrants. At eleven, he ran away to join a traveling stage act. In 1839 Singer obtained a patent for a rock-drilling machine. He formed a theatrical troupe, The Merritt Players, but after five years took a job in Ohio at a sawmill, where he designed a carving machine.

1849–50

Singer moved to Boston and worked at a machine shop where Lerow and Blodgett sewing machines were being built and repaired. He designed a better sewing machine.

1851–55

Singer exhibited his sewing machine at the Great Exhibition in London and obtained a patent for it. He partnered with lawyer Edward Clark (1811–82), who helped him with patent litigation against his sewing-machine design as well as marketing.

1856–75

Several sewing-machine manufacturers formed the Sewing Machine Combination—the first patent pool in US history. That same year, Singer's company manufactured thousands of sewing machines for home use. In 1862 he sailed for Europe where he settled, building a house in Devon, England.

INNOVATIVE MERCHANDISING

Although he yearned to be an actor, acting jobs were not plentiful, so Singer found work as a mechanic and cabinetmaker. He was practical and inventive, and his first invention was a machine for drilling rock, which earned him $2,000 in patent rights. Next, he patented a type-casting machine for printing books. Singer's sewing machines went into production with the backing of Phelps and printer George Zieber. With an astute business brain, Singer initiated several merchandising practices, including mass marketing, using women to demonstrate the machines in venues where they attracted potential buyers, and providing an after-sales service. His business partner, Clark, pioneered the hire-purchase system of buying on credit in easy instalments, which helped assure the company's success. The Singer Manufacturing Company achieved international renown with the opening of factories in Glasgow, Paris, and Rio de Janeiro, and by 1890 it had 80 per cent of the worldwide market share.