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Mechanical Transformations: the Active Roles of Machines In British Industrial-era Writings

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ABSTRACT

Industrialization defined nineteenth-century Britain, bringing large-scale changes to the social order. Observers perceived that machines stood at the heart of these changes as much as inventors, manufacturers, and operatives, if not more so. A range of writers expressed their awareness of the transformative power of technology by endowing machines with a sense of life and influence according to four broad characterizations: machines as instruments of civilizational advancement disguised as mundane tools, organic life, bringers of order, and near-mythical embodiments of power. Critics of industry co-opted such lofty language and turned it on its head to depict machines as destructive, sometimes monstrous forces. More broadly, nineteenth-century sources indicate a perception of machines as channels for the human will, for better and worse, performing tasks that human beings cannot accomplish alone. A study of NASA's dramatic retirement of the *Cassini* space probe illustrates how nineteenth-century characterizations of machines have persisted into the twenty-first century. In conclusion, the influential roles in which industrial-era authors cast machines derived from their power and seeming autonomy as well as from their close relationship to human beings and human ambition. As automation advances in the twenty-first century, the tendency to personify machines will also persist in forms that evolve with time and technological change.

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CHAPTER I

INTRODUCTION

In 1803, poets Dorothy Wordsworth, her brother William, and Samuel Taylor Coleridge passed through a mining village on a tour of Scotland, where they saw a steam-powered water pump in operation. The three companions understood the device's practical purpose – removing water from the mine shaft – but this knowledge did not hinder their imaginations. In her travel journal, Wordsworth noted the order and "unison" the pump and engine house seemed to impose on their environment.[1] She recalled Coleridge describing the machine as a single-minded "giant," while she herself likened the regular breaks in the pumping cycle to pauses for breath.[2] She then made an even more striking observation: "It was impossible not to invest the machine with some faculty of intellect; it seemed to have made the first step from brute matter to life and purpose, showing its progress by great power."[3] The pump was apparently coming alive.

Wordsworth and her fellow poets sensed that machines, while not literally achieving life, were in the process of becoming active players in industry. Throughout the late eighteenth and nineteenth centuries, many additional witnesses to British industrialization recognized that the devices with which they lived and worked were rapidly gaining autonomy. Though these observers all understood machines as active

entities, they responded in different ways. Some attempted to disguise mechanical autonomy, some decried it, and others promoted it. A spectrum of imaginative conceptions of machines emerged, containing a core set of recurring traits which both critics and proponents of industry ascribed to machines to advance their arguments. Dorothy Wordsworth applied four such traits to the pumping machine she saw in Scotland: she identified the device's practical function as a labor-saving tool; she perceived suggestions of organic life; she noted the order and stability it brought to its surroundings; and she marked its power, which she defined as the key sign of the pump's apparent transition to life. This thesis seeks to demonstrate that authors endowed machines with this sense of activity and influence because they conceived of machines as agents of social transformation. Such writers depicted machines' involvement in this transformation according to the four broad characterizations exemplified by Wordsworth's observations above. The following chapters explore these characterizations and possible sub-motivations for their use.

Historians most often approach industrial-era machines in the context of economics and labor issues. While these topics are inextricable from any discussion of machines, the present analysis included, this thesis instead focuses on the mental and imaginative stimulus machines provided to the people who witnessed their rise. Some scholars have articulated similar perspectives. For instance, in *Manufacturing Culture: Vindications of Early Victorian Industry* (2003), Joseph Bizup argued that industrial advocates saw machines and their products as beautiful embodiments of the logic that created them and the orderly industrial society they engendered.[4] Likewise, in *Victorian Technology: Invention, Innovation, and the Rise of the* Machine (2009), Herbert Sussman described the

machines displayed at the Great Exhibition of 1851 as a spectacle, symbols of human genius and Britain's spirit of invention.[5] Finally, Tamara Ketabgian probed machines' literary presence in *The Lives of Machines: The Industrial Imaginary in Victorian Literature and Culture* (2011). This work approaches machines not as the sterile, lifeless antithesis of humanity, but as complex symbols Victorian authors utilized to represent human behaviors, emotions and desires, and gender norms. Ketabgian's central question, "What might it mean to feel like a machine?", asks the reader to consider the ways in which industrialization blurred the boundary between the organic and the mechanical in the nineteenth-century imagination.[6] This thesis expands upon these prior works, contending that nineteenth-century authors imagined machines not only as symbols of social change, but as motive forces at the heart of that change.

This analysis incorporates a range of primary sources, including social commentaries, treatises on the factory system, and poetry and literature, while also employing a close examination of language. Machines shared intimate relationships with the residents of industrializing Britain, oppositional in some cases and collaborative in others. Given these close ties, mechanization cannot be fully understood without examining the ways observers thought about machines themselves. Although the four traits Wordsworth applied to the Scottish pumping machine do not encompass all such conceptions, they represent some of the most common, and thus they serve as the backbone of this analysis. Many of the authors discussed here wrote in the 1830s and 1840s, when factory reform and regulation were prominent topics of debate; however, the characteristics under examination are not exclusive to this period. Some writers used them as early as the 1790s and as late as the turn of the twentieth century. Their works are also discussed here.

Each of the following chapters analyzes one of Wordsworth's characterizations and the manner of its use. We begin by investigating industrial advocates' attempts to quell fears of mechanization by portraying machines as tools or helpful partners. Such authors employed this language not only to render machines less threatening, but also to discourage machine-breaking and governmental regulations that might limit factory owners' autonomy. Next, we consider authors who depicted machines as living beings: extensions of the natural world, imitators of humanity, or a new kind of life altogether. New automatic machines, particularly those in textile factories, performed human labor, a quality which encouraged personification. Some writers used the image of the living machine to make machines more acceptable, while others did so to highlight what they saw as a disturbing alignment of the natural and the mechanical. The last two characterizations of machines are closely related: one depicts them as revered bringers of order, while the other presents them as embodied power. Writers who used these characterizations often believed that mechanization would deliver humanity – perhaps completely – from the burden of manual labor. They also attempted to deflect attention from the perceived moral degradations of the factory system by portraying machines as blessings of science. In their eyes, mechanization represented the full flowering of an ancient human desire to create. They saw machines as both the children and the saviors of humanity. As such, they employed romantic or mythological language sometimes verging on deification. Through this language, they expressed their attraction to mechanical power and the opportunities such power represented socially and economically. Although it was lovers of machinery who most often used these quasi-divine personae, social reformers turned the same

characterizations to their own contrasting purposes. Their reinterpretations of pro-industrial language are also presented in these two chapters.

Finally, although technology has changed form over time, machines still enjoy vivid lives in the human imagination, and the tropes applied to them in the eighteenth and nineteenth centuries have not faded. This analysis closes with a modern case study of NASA's *Cassini* space probe and the public response to *Cassini*'s quasi-death, which illustrates how industrial-era perceptions of machines persist in the twenty-first century. Like early industrial machines, *Cassini* acted as an extension of human beings, and this close link between technology and human accomplishment continues to encourage the personification of machines much as it did in centuries past. Today, as in the years of industrialization, machines act as channels of the individual will or ambition. They represent not only physical power, but also the power to achieve goals: to dominate the economy, overcome obstacles, and change society.

Both critics and advocates of British industrialization recognized the potential of mechanization. Steam enabled early machines to evolve, growing larger and stronger than ever before. Even reformers spoke of mechanical power with awe, though they feared its effects. Today, the scale of stationary steam engines, no longer used but preserved by museums, still stirs a sense of strength and possibility. The wonder or intimidation machines evoked serves as a common thread binding the sources presented in this thesis, from the industrial era to the present.

CHAPTER II

EUPHEMIZING MECHANIZATION

In 1830, a contributor to the *Westminster Review*, a liberal journal, received a singular letter to which he felt compelled to respond. The letter criticized the punishments authorities gave machine-breakers and was signed "Swing" – a collective name for displaced agricultural laborers, who in 1830 protested the loss of their livelihoods by breaking threshing machines, threatening farm owners, and vandalizing property. Rather than report Swing, the *Review* contributor determined that his correspondent must be an "ill-used gentleman" led astray by ignorance and undertook to educate him.[1] In his response, the contributor argued that it was not machines that were evil, but rather the government taxes and tariffs that limited the distribution of their produce and thus employers' hiring ability.[2] Machines could harm the working classes if introduced too quickly, but they were ultimately a blessing. They allowed for less strenuous, more efficient labor and provided cheaper goods to everyone, the poor included, and therefore to break them "would be such gross absurdity, that it is hardly practicable to set about stating wherein the absurdity consists. It is like a man's cutting off his legs, in order that he may have the pleasure of hopping upon crutches."[3]

Although the *Review* contributor sympathized with Swing's plight, he characterized the anti-machine perspective as ill-informed and illogical. This was common in the 1830s. Many people had reason to fear machines, workers most directly, though members of other classes were also disturbed by reports of factory cruelty. Industrial advocates like the *Review* contributor, however, believed that such fears stemmed from ignorance or misinformation. They themselves welcomed the growing presence of machines, and they believed that with some education, the English people would too. However, proponents of industry did not directly attempt to persuade the public to accept machines' influence on society. Instead, they endeavored to ease fears by depicting steam-powered machines as the latest in a long line of useful but mundane tools, thus offsetting the sense that these devices differed from all the familiar and unthreatening machines preceding them. The *Review* contributor did so himself by comparing machine-breaking to cutting off one's legs. To him, threshing machines were to agriculture what legs were to locomotion: so natural, indispensable, and ordinary that they hardly warranted thought, much less resistance. However, this veneer of banality was thin. Industrial advocates, despite their attempts to convince the public of the contrary, did not see machines as passive tools but as extraordinary, revolutionizing entities. This view informed their writings, revealing glimpses of machines as far more than instruments of labor.

2.1 The Mask of Mundanity

Charles Knight's *The Results of Machinery* (1831), written in the wake of the Swing riots, is a prominent example of industrial advocates' efforts to depict machines as everyday objects. Knight oversaw the publication of various works under the auspices of the Society for the Diffusion of Useful Knowledge (SDUK), which aimed to educate

people with limited formal schooling by presenting current events and scientific developments in an understandable manner. *The Results of Machinery* embodies the same spirit. The work rests on the well-intended but paternalistic assumption that workers' hostility towards machinery stemmed from ignorance or misunderstanding rather than experience, and that intellectuals ought to correct this misconception. Knight treated machine-driven downsizing and the displacement of handworkers simplistically, however, concluding that workers had to adapt to the changing times. He believed that some laborers would lose their jobs, but many more would find work in the new mechanized trades if they were only willing to adjust.[4] This assertion reflected the laissez-faire capitalism common to so many nineteenth-century defenses of industry, an economic philosophy that not only accepted but embraced machines as the inevitable and beneficial result of technological advancement. According to this perspective, intervention in the economy, particularly for the purposes of factory regulation, was an obstruction of progress "by the ignorance of a government."[5]

In *The Results of Machinery*, Knight presented technological and economic change as a blessing, and his characterization of machines advanced this argument. Superficially, Knight scarcely gave machines any persona or sense of activity at all. He almost never anthropomorphized them, and although he noted their power, he did not invest them with supernatural qualities or describe them in mythological terms. Knowing what Knight sought to argue, however, it soon becomes clear that this seeming lack of a persona was a persona in itself. Knight's stated goal was to convince the English people, especially workers, that they had nothing to fear from mechanization, so he depicted contemporary machines as mere tools, differing from all the tools that came before only in their power

and complexity. The textile machinery of the 1830s was, in his framing, little more than the latest in a long line of useful devices stretching back to the wheel and the plow.[6] Such ancient machines, Knight claimed, were essential to the development of human society: they enabled road and ship building (Knight argued that sailing ships were themselves machines), effective communication, and the efficient delivery of goods.[7] New machines were the same. They decreased exertion, saved time, and allowed many people to acquire the necessities of life at reduced cost; thus, it would be irresponsible to reject them.

By employing such logic, Knight stripped the machine of its majesty and its striking – or perhaps unsettling – ability to imitate life. In his framing, the steam-powered loom did not necessarily portend complete automation and the replacement of human hands by faster, cleverer mechanical ones. It was instead no different than a spade, an instrument of human advancement with no lifelike qualities of its own. Knight was careful, too, to indicate that machines were in no way superior to human beings despite their greater physical strength. To him a human was "beyond all comparison, a machine more cunningly made by the hands of his Creator, more perfect in all his several parts…than the most beautiful machine that ever was, or ever will be, invented."[8] He added that a machine's perfection lay not in its clever construction, its mechanical strength, or its efficient use of natural forces, but in its ability to bring previously impossible tasks within the reach of human beings.[9] Though Knight may have privately perceived machines as miraculous, superhuman objects, he did not glorify them this way in *The Results of Machinery*. Instead, in keeping with his efforts to depict machines as everyday tools, he celebrated their power only because it served humanity so well.

Knight's conflation of steam-powered machines with the handheld machines of earlier eras was an oversimplification. Middle-class readers with no experience of mechanized labor might not have known the extent of the difference, but workers would have, many having lost their livelihoods and labor autonomy in the transition to machine power. The mundanity and subservience with which Knight attempted to endow machines would not likely have fooled the working classes. To the literate among them, it would have been as clear as it is to the modern reader that Knight had thrown a thin veil of docility over a world-altering technological advancement. Knight himself could not entirely disguise this. At the beginning of *The Results of Machinery*, he warned that when workers broke machines in protest against the loss of their livelihoods, they did so not knowing that the coming of the machine was inevitable and indeed already in motion.[10] He also depicted machines as agents of utopia, arguing that "the more machines are multiplied…the more society approaches towards perfection."[11] For all his attempts to reduce contemporary machinery to the status of the wheel, he could not quite conceal the juggernaut he believed it to be, and which in many ways it was.

Knight summarized the ideas of *The Results of Machinery* in an 1830 pamphlet entitled "An Address to the Labourers, on the Subject of Destroying Machinery," distributed by the SDUK. In addition to educating the public, SDUK members hoped that their works would counteract the rhetoric of the various socialist and radical journals marketed to the working population. As such, the organization's writings were generally pro-industry and anti-regulation. Knight's pamphlet was no different. The arguments he set forth in "An Address to the Labourers" were essentially the same as those of *The Results of Machinery*, albeit abridged. At the beginning of the pamphlet, he wrote that "the word

Machine seems to convey to your minds, some contrivance necessarily attended with mischief to the Poor; whereas, in Truth, the word Machine means the same as Tool or Instrument…."[12] Here he adopted the same paternalistic tone, the same assumption that workers could not form valid opinions through their own experiences. Here too, he personified the machine as an innocuous laborer's aid.

"An Address to the Labourers" differs subtly from *The Results of Machinery*, however. In the pamphlet, Knight made a suggestion at odds with his attempt to reduce steam-powered machinery to a mere tool: namely, that God gave human beings great intelligence to offset their physical weakness, and from this divine gift came all the world's useful inventions, machines included.[13] Other industrial advocates made the same argument – that machines derived from a divine creative spark – and more extravagantly than Knight. In the context of Knight's pamphlet, this implication nonetheless constituted a flaw in the characterization of machines Knight endeavored to construct. If machines were truly as ordinary as Knight would have had his audience believe, one would not expect to find their ultimate origins in God. This idea invests the machine, however briefly and obliquely, with hints of the miraculous. It also suggests that Knight did not subscribe to the euphemisms he presented to his readers, and that he was fully aware of the titan beneath the veil.

In his pamphlet, Knight also predicted that machine-breaking would inevitably lead to the regression of Western civilization. He appealed to workers' sense of moral duty to help guard against this deterioration. In the concluding paragraph of "An Address to the Labourers," he noted that threshing machines prevented a tenth of the national grain output from going to waste due to insufficient labor, which he claimed was enough to make the

difference between a rich harvest and a poor one. "Whoever breaks these machines, therefore," he cautioned, "does as much harm to the country as if he had made a dearth in it."[14] Like the suggestion that machines derived from God-given creativity, this admonition weakens Knight's argument that nineteenth-century machines were no more significant or extraordinary than any other labor-saving devices. Instead, he endowed them with a weightier purpose: in processing grain that might otherwise be wasted, machines assumed the role of providers. In Knight's eyes, those who stood in the way of this protective work might just as well have brought famine upon the country themselves.

2.2 Everyday Object or Instrument of Civilization?

As simplistic as Knight's arguments may appear, he was not alone in his attempts to ease public fears by shrouding machinery in banality. Two years after *The Results of Machinery* first appeared, the *Dublin Penny Journal* published an article entitled "What is a Machine?" The piece was indebted to Knight's work; in fact, the author, denoted simply as "F.", reiterated Knight's assurance that human beings, as creations of God, would always be more perfect than even the cleverest machines. In commenting on mechanization in England, F.'s views diverged from Knight's only in that F. believed machinery had been introduced too fast for the common good. F. argued that workers were not too slow or too stubborn to adapt, as Knight implied, but that they were not given a chance to adapt at all, and this caused mass displacement.[15]

Otherwise, the two works are near twins. Like Knight, F.'s central argument in "What is a Machine?" was that machinery was natural and ubiquitous, and that contemporary devices shared the same lineage as all the ancient handheld instruments which enabled human societies to evolve. F. thus invoked the same characterization of

machines as Knight – the harmless, unconscious tool – and conflated "the lance tipt with fish-bone – the two rough stones for grinding corn – the sharp instrument of shell, stone, or bone, for cutting, stabbing, and carving" with steam-powered machinery.[16] The author concluded that "if machinery, therefore, is not to be introduced into Ireland…we should break up our steamboats, demolish our windmills, fling away our knives and forks, smash our crockery, burn our calicoes…and survey the wilderness which our folly has created!"[17] Although F. qualified this conclusion with the warning that the new technology must be introduced slowly, he, like Knight, insisted that machines had not fundamentally changed since the introduction of steam power. "Whatever a man uses, in addition to his hands, his fingers, and his nails, is a machine," F. wrote. "Therefore machinery is as old, or very nearly so, as the world."[18]

These assertions notwithstanding, F. presented machines as irresistible forces more convincingly than as mere tools. A month before "What is a Machine?" appeared, the *Dublin Penny Journal* ran a piece entitled "The Rise and Progress of Cotton Spinning," in which F. traced the ancient history of cotton production and discussed the various inventions that led to Richard Arkwright's now-famous spinning frame. Here F. again warned against the rapid, disruptive introduction of machinery into England, but he also suggested that it was both futile and detrimental to resist the spread of mechanization. Despite his apparent concerns, he wrote that machines had released human beings from the hardship, exhaustion, and monotony of their "half civilized state," thus enabling them to devote themselves to intellectual pursuits.[19] As in "What is a Machine?", he cast steam-powered devices as docile, helpful partners that gave workers the leisure to sharpen their minds rather than degrade their bodies. F. nonetheless perceived that such devices were not

so innocent, as his proposal for easing the transition to machine power showed. English working-class poverty, he argued, increased partly because machines were too powerful for that country's narrow borders. Though F. tried to convince his readers otherwise, he recognized that this new power was not like a grindstone or a knife or a plow. It was a giant, and it "require[d] an ample field to play upon."[20] In economic terms, if England were to overcome its struggles with glutted markets and unemployment, it had to implement free trade in accordance with its new manufacturing capacity. This warning undermines F.'s efforts to soothe fears of industrialization; in fact, it would have alerted the public that there were valid reasons to fear. If machines were not given the space they needed to exercise their power, they would bring suffering upon the very people they were meant to serve.

Neither F. nor Knight fully subscribed to his own argument; those constructs were meant for the uneasy public, not the authors. Knives, forks, and windmills are in no way comparable to a steam engine or a steam-powered loom. These older devices lack the same power, scale, imaginative stimulus, and socioeconomic influence. Moreover, although Knight and F. attempted to create an innocuous persona for machines, they both allowed the colossus or the juggernaut to slip into their writings. Mechanization signified to them more than efficiency and economic growth, and to stand in its way would be to drag humanity back into a dark age of onerous manual labor and intellectual stagnation. Reading between the lines, Knight and F. conceived machines as unstoppable but ultimately enlightening forces. Mechanization would inevitably come and cause temporary chaos and suffering, but when the dust settled, humans would progress beyond the struggles of the more primitive past. They would become, mentally and spiritually, "like the eagle, preparing its plumes to stretch into the empyrean!"[21] In short, nineteenth-century England

was civilized because it was mechanized, a notion that remains imprinted on Western concepts of modernity today.

Both F. and Knight thus recognized the revolutionizing power of machines, and their writings made this plain despite their arguments to the contrary. Moreover, their comparisons of steam-driven machinery to handheld tools are so simplistic that anyone with a general knowledge of steam power – certainly workers in mechanized trades – would not have been convinced. Such oversimplicity obscures the intended audience of the pieces presented above. On one hand, these works appeared just after the Swing riots. This explains the title of Knight's pamphlet, "An Address to the Labourers," and the subtitle of *The Results of Machinery*, "being an address to the working-men of the United Kingdom." However, these defenses of industry also closely predated the passage of the 1833 Factory Act, which set standards for the treatment of workers, particularly child laborers, and established an inspectorate to enforce them. Fierce debate on the role of government in the economy and the nature of machines – blessing or curse – preceded the act's approval. This debate was carried out largely by educated reformers and industrialists and their supporters rather than laborers themselves. Given the feeble comparisons F. and Knight employed, it seems likely that they intended their publications as much for the middle-class participants of the factory debates as for workers themselves, if not more so. They euphemized machines not only to convince workers to embrace industrialization, but also to remedy what they would have perceived as sensationalism on the part of factory reformers. Their writings provided alternatives, however naïve, to the sour taste that exposés on factory brutality had left in the literate public's mouth.

CHAPTER III

THE ORGANIC MACHINE

For actress Fanny Kemble, the Thames Tunnel was a magical place. Designed by I. K. Brunel and completed in 1843, the tunnel ran beneath the River Thames to connect two London boroughs, a feat of nineteenth-century engineering. The structure alone impressed Kemble when she toured it in 1827, early in its construction. Recalling the visit in her memoirs, she described the passage and its many gas lamps as a fairytale "avenue of light" leading to a genie's secret lair.[1] To Kemble, however, the machines employed to help build the tunnel were even more striking. She was at first overwhelmed and then spellbound by the noise and apparent exertion of the devices working all around her, which seemed to labor with as much consciousness as their human counterparts. "I should have liked to look much longer at all these beautiful, wise, working creatures," she wrote, but to her regret, her party had to move on.[2]

Pro-industrialists like Charles Knight and the *Dublin Penny Journal* depicted machines as mere instruments of labor to counter public fears of machines' growing influence and autonomy. Kemble and like-minded writers, however, did not conceal their perception of machines as active participants in labor with an apparent life and will of their own. It is unlikely that Kemble thought the tunnel machines "wise" in any literal sense, but

she saw something in their work that suggested consideration and cleverness. This view might seem fanciful, but it was not unfounded. Automation became increasingly prevalent in the late eighteenth and early nineteenth centuries, and machines performed ever more tasks that once required skilled human hands. This development created observable parallels between industrial machines and living things.

Writers on both sides of the industrialization debate perceived such similarities, though not always in ways that flattered machines. Critics used organic imagery to express their discomfort with the rapidly blurring boundary between the natural and the mechanical, or to compare machines to unlovely aspects of nature. The Romantic poet William Wordsworth, for instance, often juxtaposed the industrial and the natural to amplify his idealization of rural life. In one poem he described industry as an "outrage done to nature" and expressed the hope that one day human wisdom would restrain this great force.[3] Despite his distaste for industry, he recognized that machines were wondrous accomplishments, "…a purpose given,/ A perseverance fed; almost a soul imparted/ To brute matter."[4] To him machines were not threatening or unnatural because they appeared to be alive, but because their living power "dazzled" humanity and led to the greedy exploitation of nature.[5] Wordsworth hoped for harmony with nature, or benign human dominion at the least, rather than conquest.

3.1 Spirits of Steam: The Poetic Vision of Erasmus Darwin

Proponents of industry did not share Wordsworth's concerns; in fact, some saw no discord between machines and the natural environment. They used the language of nature in ways that made machines seem less jarring, romanticizing industry much as Romantic poets idealized the English countryside. Erasmus Darwin's *The Botanic Garden* (1791),

written when steam had not yet completely replaced waterpower, is an early illustration. Like his grandson Charles, whose theory of evolution has since become a cornerstone of biological science, Erasmus Darwin was fascinated by the natural world, particularly plants, and by the evolution of life. He was also an inventor and a proponent of industry. In 1765 he founded the Lunar Society of Birmingham, a loose association of naturalists and industrialists. The group's membership included some of the most prominent figures in the history of British industrialization, such as James Watt, improver of the steam engine, and Watt's business partner Matthew Boulton.

The theme of mechanization figures prominently in the two poems that comprise *The Botanic Garden*: *The Economy of Vegetation* and *The Loves of the Plants*. The poems encompass a wide variety of subjects: comparisons between plants and human sexuality, prescient warnings of climate change, ruminations on evolution, and da Vincian flights of invention. In addition, *The Botanic Garden* contains, both in the footnotes and in the poetry itself, many references to new industrial technology, often set against the backdrop of the natural world. Through these references, Darwin demonstrated that he saw no conflict between organic life and machines. For example, in describing Richard Arkwright's water-driven cotton mill on the River Derwent, a forerunner of the factory system, Darwin vividly married the human, the mechanical, and the magical:

> – First with nice eye emerging Naiads cull
> From leathery pods the vegetable wool;
> With wiry teeth *revolving cards* release
> The tangled knots, and smooth the ravell'd fleece;
> Next moves the *iron-hand* with fingers fine,
> Combs the wide card, and forms the eternal line;
> Slow, with soft lips, the *whirling Can* acquires
> The tender skeins, and wraps in rising spires;
> With quicken'd pace *successive rollers* move,

And these retain, and those extend the *rove*;
Then fly the spoles, the rapid axles glow,
And slowly circumvolves the labouring wheel below.[6]

In this description of cotton-spinning, the machinery is distinctly anthropomorphic. Its fingers comb out the raw yarn with the dexterity and gentleness of a person combing hair. The water wheel is not a mere tool, passively providing power to the mill machines and thus reducing human exertion; instead, it exerts itself as an active laborer in cotton production. In contrast to this slow-moving wheel, the spools "fly" as if racing eagerly to complete their task. Finally, in the canister which passes the cotton to the rollers, Darwin perceived a pair of lips – and soft lips, at that. As the machine stretches the cotton to fineness, it is not an amalgamation of wood and metal, but rather a lover bestowing a gentle kiss.

This is the most human depiction of machinery in *The Botanic Garden*, but elsewhere, Darwin also aligned industrial technology with non-human aspects of the natural world. For instance, he provided a mythological vision of Thomas Savery, who is credited with inventing the steam-powered water pump:

Nymphs! You erewhile on simmering cauldrons play'd,
And call'd delighted *Savery* to your aid;
Bade round the youth explosive *Steam* aspire
In gathering clouds, and wing'd the wave with fire;
Bade with cold streams the quick expansion stop,
And sunk the immense of vapour to a drop….[7]

Here it is nymphs, mythological embodiments of nature, who inspire Savery to his invention. Moreover, they seem to provide the steam itself, and the water which drives the pump's necessary cycle of heating and cooling. They also command the air which presses the piston into its downstroke. The machine thus acquires both mythical and organic

dimensions. It operates by the intervention of the nature spirits who supply its power, and indeed, it is inseparable from the forces of nature it utilizes. Savery himself is "called" to the nymphs' service; he employs and is employed by nature. Far from a bleak portrayal of nature despoiled by human industry, Darwin envisioned the two forces working in harmony, with Savery as the intermediary.

Like many of his fellow thinkers, Darwin believed that machines could benevolently tame and perfect natural forces.[8] However, he could not escape moments of dissonance. In the next few lines, the pump becomes a titan, laboring exhaustlessly to drain the water from a mine shaft so that its precious coal can be extracted:

> The Giant-Power from earth's remotest caves
> Lifts with strong arm her dark reluctant waves;
> Each cavern'd rock, and hidden den explores,
> Drags her dark coals, and digs her shining ores.[9]

This human invention, then, given life by the powers of nature, masters nature itself. The waters in the mine are "reluctant" to be drained by the pump; they must be drawn out by a "Giant-Power" stronger than they. Yet Darwin did not depict the pump as a monster of wood and metal, but as a living – albeit superhuman – entity. It has limbs which it wields with strength and exertion. It even has a sense of curiosity: it does not merely dig out minerals from the mine shaft; it "explores" the hidden depths its labors have revealed. But although the pump uses the gifts of nature to impose its own will on the earth, it is not antithetical to nature. Instead, it is a quasi-divine being born of the union of human ingenuity and natural forces.

The presentation of machines in *The Botanic Garden* commingles several images. At the very least, the machines imitate human labor, and at most they show a spark of life. They are bound to nature, as they rely on natural forces to do their work. They are also

titans, capable of dominating nature through the intervention of the human mind. All three characterizations – the human machine, the natural machine, and the godlike machine – became prominent in the decades after Darwin's poetry appeared, as steam power achieved ubiquity. We have seen some of these facets revealed in Charles Knight's work. What is notable, however, is that Darwin employed such descriptors so early in the Industrial Revolution. Steam-powered technology had not yet achieved predominance when *The Botanic Garden* was published, but already Darwin perceived in it the life, loftiness, and near-omnipotence which would be taken for granted by later industrial advocates witnessing the spread of the factory system and the introduction of increasingly efficient machines. In his poetry, Darwin moved beyond a mere appreciation for machinery and introduced an element of reverence, presaging some of the best-known (and perhaps infamous) works of the Industrial Revolution.

3.2 Magical Realities

Erasmus Darwin did not work in a factory himself, nor did the well-educated industrial advocates of the 1830s and 1840s, which may explain their idealism. Other observers, equally unacquainted with the realities of factory work, perceived the same magical life in machines. For example, in her *Record of a Girlhood* (1878), Fanny Kemble recounted a ride on the Liverpool-Manchester Railway, the first intercity railway in the world, several weeks prior to its public opening in September 1830. She too invoked the language of nature, this time by comparing the locomotive to a horse. This "fire-horse," as Kemble called it, consumed coals instead of oats, had pistons and wheels for limbs, and snorted in such a way that Kemble felt "rather inclined to pat" it.[10] She then described the fantastical journey of this "brave little she-dragon," made "without any visible cause of

progress other than the magical machine, with its flying white breath and rhythmical, unvarying pace."[11]

Mechanization and modernization interested many nineteenth-century literary figures, Charles Dickens prominent among them. His novels are well-known today for bringing to light the struggles of the working class, particularly the children of the poor, and critiquing the British government's handling of social ills. However, despite these criticisms of industrialization, Dickens, like his more sanguine contemporaries, found life and charm in some machines. In 1850, as editor of the magazine *Household Words*, he published a short, lighthearted article observing that steam locomotives appeared to have personalities. They were "low-spirited" in wet weather, but "very cheerful and brisk" when the weather was good.[12] Some would accept large amounts of fuel at once; others, like fussy children, had to be resupplied gradually. Some, like horses, even seemed to prefer certain handlers over others. Speaking in the voice of one such locomotive, Dickens wrote, "If it's Smith who is to drive me, I won't go. If it's my friend Stokes, I am agreeable to anything!"[13] He concluded with a gentle critique of the government: railway workers did not treat all their engines the same way, without regard for their eccentricities and individual needs, so the government should not do so with human beings.[14] In *The Lives of Machines*, Tamara Ketabgian interpreted this admonition as suggesting that mechanical individuality could help people to better understand human individuality in turn.[15]

Some of the quirks Dickens described, such as an unwillingness to work in rain or fog, have mechanical explanations. The perceived differences in how locomotives responded to different engineers may have resulted from variances in skill. In addition, locomotives built by different makers did not run precisely the same way, which might

account for some of the eccentricities Dickens observed as well. Despite such practical explanations, however, when these quirks are considered together, it is not difficult to see why Dickens regarded locomotives as individual beings.

Dickens's view was pervasive and lasting. Beyond nineteenth-century Britain, other writers noted the same individuality. In 1906, American minister and essayist Gerald Stanley Lee published a collection of reflections entitled *The Voice of the Machines*, in which he asked, "Does anyone know an engineer who has not all but a personal affection for his engine, who has not an ideal for his engine, who holding her breath with his will does not put his hand upon the throttle of that ideal and make that ideal say something?"[16] More than half a century and an ocean removed from Dickens, Lee discerned the same profound, even spiritual connection between an engineer and a locomotive, the same breath and life within the engine itself. Trains continue to excite both children and adults even today. Designs and fuels have changed, but a twenty-first-century train passing through a railway crossing impresses the same sense of power and muscular exertion as a steam locomotive in 1830.

Kemble, Dickens, and Lee approached machines with curiosity and wonder, an unsurprising response given the sheer scale and potential of this new technology. They had the luxury of wonderment because mechanization did not threaten their livelihoods, nor would they ever have to race with tireless factory machines for long, exhausting hours. Their lack of technical knowledge also allowed them to idealize machines undeservedly. However, not everyone who looked upon machines with awe or discerned life within them led lives of comfort. Indeed, Kemble's reaction to the opening of the Liverpool-Manchester Railway bore similarities to the response of Alexander Somerville, a Scottish journalist

whose widely varied occupations included soldier, manual laborer, and Chartist activist. In his autobiography, Somerville wrote that as he observed the railway, he was so entranced by this "most poetical and most practical of the grand achievements of human intellect" that "people thought [he] stood and slept."[17] His hope was that such technology would bring about a glorious new reality in which social distances between classes could be bridged as easily as physical ones. He also called the inventors and builders of machinery "god-like," thus adding explicit reverential overtones to his view of technological progress.[18]

It is tempting to assume that factory workers saw only inhuman, lifeless brutality in the machines they operated. Isolated from nature for large parts of the day, they had few opportunities or encouragements to draw comparisons between machines and nature. However, some workers did utilize natural imagery to describe machinery, although their metaphors were less optimistic than Erasmus Darwin's. Lord Byron, poet and British peer, noted that during a tour of Nottinghamshire circa 1812, he heard displaced artisans describe machine-spun cloth as "Spider-work." These skilled spinners and weavers were referring to the inferior quality of this cloth, much as spider silk is strong enough to ensnare insects but easily pulled down by a human hand.[19] If the cloth was spider-work, then, the machine was the spider. There are clear parallels between a spider and a spinning frame: both spin threads into complex constructions, and both are dexterous. Spinning machines also move in ways that might resemble a spider: where Erasmus Darwin saw clever fingers, Byron's workers saw a spider's legs. More subtly, spiders are often regarded with suspicion for their use of patient, cunning hunting methods. Their webs are beautiful but deadly. The

term "Spider-work," then, paints machines as deceitful, dangerous entities that promised prosperity but brought only deprivation.

3.3 Mechanical Evolution: The Living Machine in *Erewhon*

Although factory reform eventually restrained machines, rendering them less like superhuman beings and more like tools, the notion of mechanical life did not entirely fade. Samuel Butler's satirical novel *Erewhon* (1872) explores this idea, using the language of organic life to ask whether a hypothetical living machine would be benign. Butler's English protagonist, Higgs, unexpectedly finds himself in the world of Erewhon, a world that turns social norms as he understands them upside-down. Most noticeably, there is no mechanization: the only visible machines sit broken in museum cases. The protagonist reads a text, "The Book of the Machines," explaining this mystery: the people of Erewhon feared that machines might come alive. In this text, two Erewhonian authors present opposing arguments regarding the destruction of machines. Specifically, Butler used this portion of his novel to examine the notion that machines could gain sentience through Darwinian evolution. This idea might seem ludicrous, and as *Erewhon* is a satire of Victorian society, it is doubtful that Butler meant it literally. Nonetheless, he conducted this thought experiment in an age when machines had become more autonomous than ever. Butler's proposal of mechanical sentience, however exaggerated it may be, reflects certain realities of that age and the broader Victorian ambivalence about technology.

"The Book of the Machines" explains Erewhonians' fear of machine animation. First, one of its two authors – the "anti-machinist" – notes that it took living things millions of years to achieve their complex modern forms, while machines achieved similar complexity in "…the last five minutes, so to speak, in comparison with past time."[20] With

this incredible capacity for growth and advancement, the anti-machinist asks, what might machines become after millions of years of evolution? He warns that Erewhonian machines already parallel organic life in many ways, and organic life parallels machines. For instance, he defines both an eggshell and an eggcup as machines because both perform specific functions: an eggshell serves to hold an embryo while an eggcup serves to hold an egg.[21]

This is something of a logical leap, but the anti-machinist draws stronger comparisons later in the text. He remarks that, like Dickens's locomotives in the real world, machines require specific working conditions, and if these conditions are not met, they break down or endanger their operators.[22] This is true in a strictly mechanical sense, but it also presents two parallels to organic life. The first lies in the anti-machinist's choice of words: "…the moment [machines'] terms are not complied with, they jib, and either smash both themselves and all they can reach, or turn churlish and refuse to work at all."[23] This equates to a human throwing a tantrum and going off to sulk. The word "churlish" paints machines as temperamental, ill-mannered children liable to have a fit if their wishes are not met. This is a humanized depiction, though noticeably less idealistic than Erasmus Darwin's deft, tender mechanical spinner. In another parallel, this passage also recalls the machine-breakers of the late eighteenth and early nineteenth centuries and the unionists who followed. Like their mechanical counterparts, they demanded certain working conditions, and when these were not granted, they sometimes resorted to violent outbursts. This is not to suggest that machines were akin to trade unionists fighting for labor rights, or that labor activists were childish, but that machines had a very human capacity to resist conditions they found unsatisfactory. Higgs reaffirms this idea in a later footnote in which

he recalls hearing English engineers claim that machines "play pranks" on new or unfamiliar operators.[24]

More comparisons between the natural and the mechanical follow. Later in the text, the anti-machinist suggests that machines' ability to make other machines approximates an organic reproductive system. He admits this is not a perfect comparison: machines only produce parts of other machines; they do not reproduce their own kind in the manner of plants and animals.[25] However, this difference between organic and mechanical reproduction concerns rather than reassures him. He is particularly wary of the vast array of devices to which any given machine could contribute, regardless of how different the offspring might be from the contributor. "Every class of machines will probably have its special mechanical breeders," he writes, "and all the higher ones will owe their existence to a large number of parents and not to two only."[26] He fears that mechanical reproduction has the potential to become even more complex, specialized, and unrestricted than biological reproduction. While animals and plants can only re-create themselves (with some genetic recombination), machines can make parts for other machines very different from themselves, and thus collectively give rise to a much wider variety of offspring than living things can.

The anti-machinist then discusses self-regulation and adaptation – two other characteristics of biological organisms – in the context of machines:

> Let anyone examine the wonderful self-regulating and self-adjusting contrivances which are now incorporated with the vapor-engine, let him watch the way in which it supplies itself with oil; in which it indicates its wants to those who tend it; in which, by the governor, it regulates its application of strength; let him look at that storehouse of inertia and momentum the flywheel…and then let him think of a hundred thousand years…and of the doom which he is preparing for himself.[27]

It might seem that the anti-machinist makes a serious omission in this passage: he neglects to mention that human beings, not machines themselves, created all the self-regulating devices he describes. However, he does indeed address this fact in the final line, when he urges Erewhonians to consider "the doom" they are "preparing for [themselves]." This indicates that if machines do gain life and automate humans into redundancy, it will not be through the volition of the machines but through ill-advised human intervention. The question of machine consciousness aside, this is a warning against blind reverence for new inventions – a warning that rings as true today as it did in the nineteenth century. While this passage does not contain vivid anthropomorphism, it does contribute to the image of machines as active entities. Erewhonians, much like Victorians, perceive in machines an agency and authority endowed by the clever application of physics. When a machine requires something of its operators, it does not merely make requests; it "indicates its wants." This choice of words connotes a command, polite but inexorable, and makes clear that machines could bend their creators to their whims.

Some industrial advocates ambiguously depicted machines as both the servants and the superiors of human workers, as we will see in the next chapter, but the anti-machinist makes his views on this relationship clear. He confronts those who assert that machines will always remain under human control, assured in their belief that if any given device cannot serve the Erewhonian people, it will be disposed of.[28] He warns that "the servant glides by imperceptible approaches into the master; and we have come to such a pass that, even now, man must suffer terribly on ceasing to benefit the machines."[29] For all that "The Book of the Machines" contains suggestions worthy of science fiction, this passage is grounded in historical events. Artisans and handworkers were indeed of little use to the

automatic textile machines of the nineteenth century, or to the machines' owners. Some found themselves unable to adapt; some found that even if they accepted the new order, there were no jobs to be had; and many found that factory wages were far inferior to what a skilled hand-weaver might once have earned. All this came with a loss of personal and professional autonomy, and there was little choice but to accept it or face unemployment. As a Victorian, Butler would have been aware of this. His proposal of machine sentience may be facetious, but machines were indeed the masters of nineteenth-century economics. Factory labor was not the only option for the working classes – domestic service, piecework, and agriculture also employed large numbers of people – but it dominated the market, and it offered the additional incentive of regular hours. Those who did not accept mechanization found themselves in an unwinnable battle.

The anti-machinist's construction of machines as the new masters of Erewhon culminates in a dystopian depiction of what life under the rule of sentient machines might be like. The people will become like pets "and will probably be better off in a state of domestication under the beneficent rule of the machines than in [their] present wild condition."[30] As the equivalent of working animals, Erewhonians will be subject to strict discipline but spared from predation, and they will have various duties:

> …[machines] will not only require our services in the reproduction and education of their young, but also in waiting upon them as servants; in gathering food for them, and feeding them; in restoring them to health when they are sick; and in either burying their dead or working up their deceased members into new forms of mechanical existence.[31]

This might easily be read as a flight of fancy or alarmism – a sort of inverse romanticization – but nineteenth-century workers did indeed attend to machines in ways very similar to what the anti-machinist describes. "Waiting upon [machines] as servants" is the easiest of these duties to explain. Descriptions of human workers serving a power far stronger than

they, as drudges, attendants, or grateful subjects of a benevolent monarch, appear throughout the nineteenth-century literature on mechanization. While the authors disagreed as to whether this role constituted liberation or oppression, they concurred in their recognition of the immense strength of steam-powered machines.

Most of the other duties the anti-machinist presents are easily interpreted as well. "Gathering food for them" signifies supplying machines with fuel; "restoring them to health" refers to maintenance and repairs. "Working them up into new forms of mechanical existence" could mean utilizing the parts of old machines to build new ones or melting down the metal for recasting. "The reproduction and education of their young" lacks an exact translation. "Reproduction" may refer to machine shops where, overseen by humans, machines made parts for other machines. Nineteenth-century devices required no "education," nor did they take time to learn their skills, so this idea seems to belong solely to the anti-machinist's vision of a world ruled by sentient technology. "Burying their dead" may signify the real-world process of dismantling and scrapping obsolete or irreparable machines, or perhaps the anti-machinist envisions that in the future, the Erewhonians will hold funerals for the machines that ruled so beneficently and provided for such prosperity. Apart from "educating their young," however, the anthropomorphisms in this passage readily align with aspects of nineteenth-century factory labor. The extravagant language of the mechanical despot conceals legitimate examples of human subordination to and reliance on machinery.

Machines as portrayed in *Erewhon* reflect the influence of several nineteenth-century depictions. They are part of nature, being subject to Darwinian evolution, yet they surpass organic life in their capacity to evolve far more rapidly. Transcending the mere

imitation of life, they have the potential to achieve sentience. They have distinct personalities: they refuse to work when their terms are not met and fall prey to fits of temper. They also rule with a firm but gentle hand, asking their operators to attend only to the barest necessities. Not all Erewhonians (or perhaps Butler himself) believe the development of machine sentience is inevitable, however. At the end of "The Book of the Machines," the "machinist" author provides a method for avoiding this grim future. It is itself an existing nineteenth-century characterization, adopted unconvincingly by Charles Knight in his defense of industry: the machine as a tool. If the subjugation of the Erewhonians is to be prevented, machines must be treated as nothing more than extensions of the body. As the machinist views Erewhonians as "machinate mammal[s]," this is a natural role for such devices.[32] Like Knight in England, Butler's machinist concludes that "[a] machine is merely a supplementary limb; this is the be all and end all of machinery."[33] Had this persona convinced the English public when first articulated by Knight, it would have stripped away machines' mystique and rendered them more powerful cousins to any number of handheld tools, with little to no semblance of life. As it was, it convinced neither reformers, displaced artisans, nor advocates. The former two parties continued to argue for machines' destructive influence while the latter continued to promote mechanization with reverence despite their outward assurances of mechanical banality.

Even treating "The Book of the Machines" as a satirical thought experiment, there is a core of realism to the fears expressed within. The people of the nineteenth century, like the Erewhonians, were disturbed by the rapid advancement of machinery and the extent to which humans depended on and revered it. In the next chapter, we will see that it was not at all uncommon for nineteenth-century authors on both sides of the debate on

mechanization to depict machines in overtly supernatural terms. Even Knight, for all his efforts to soothe the anxieties of technological change, insisted that machines were not superior to humans only as a brief caveat to his exaltations of mechanization. In reading such works, it becomes clear that the concept of the living machine, whether literal or figurative, was present in the popular imagination decades before Butler wrote *Erewhon*. His notion of machine consciousness may well have arisen in part from this context. His work, however, stands in stark contrast to that of Erasmus Darwin and others like him. Although Butler utilized the same perception of mechanical life, he presented a very different facet of that life: not the gentle lover or curious explorer of *The Botanic Garden*, but an inexorable master. However Butler himself viewed this idea, it in fact reflects working-class experience more accurately than any of Darwin's metaphors. It also carries a subtle implication that industrialists were no more the masters of machines than the workers, for industrialists, too, owed much of their livelihood to mechanization.

CHAPTER IV

MECHANICAL ORDER SPARKS MACHINE VENERATION

In the months preceding the passage of the 1833 Factory Act, issues of labor exploitation lay heavily on the popular consciousness. The Sadler Report, which detailed the findings of a committee on child factory workers, was released to the public early that year, exposing disturbing abuse that made plain the need for industrial regulation. It seemed apparent that, unrestrained, machines brought only chaos and societal regression. It was in this context that the *Dublin Penny Journal* made a remarkable comment about mechanization in England, one that contrasted sharply with the tenor of current events: the paper claimed that machines had made human beings "the lord[s] of creation."[1] This is a striking assertion even today, with its evocation of the promise of Genesis that humankind shall have dominion over the earth. It was through machines, the *Journal* implied, that human beings would realize their God-given birthright and take command of both the natural and economic worlds. Wielding mechanical ingenuity, the people of the nineteenth century would transcend their own crude state and build an orderly civilization out of the chaos of primitivism.

Industrial workers received no such blessings from machines. Though mechanization imposed discipline in the workplace, it disordered workers' lives in many

other ways. Reformers brought attention to a range of social ills associated with factory work, including the exploitation of children, the mingling of the sexes, the dissolution of the family unit, and religious apathy. However, these efforts did not convince everyone; in fact, many commentators agreed with the *Dublin Penny Journal*'s interpretation. With the expansion of the factory system in the 1830s and 1840s came a genre of treatise not only explaining but praising the merits of mechanized manufacturing. The authors of these works saw machines as bringers or embodiments of order, not chaos. They conceived of order in several broad, often interconnected ways, ranging from the physical to the social: mechanical regularity and efficiency, workplace discipline, command of the environment, and, as the *Journal* described it, civilizational sophistication. The figurative language with which they surrounded machines expressed their absolute faith in technological progress. Their admiration also served as a counterpoint to depictions of the factory system as immoral and unnatural. They saw machines as the fruits of God-given creativity and thus objects of as much pride and reverence as machine-makers.

4.1 Taming Nature from the Environmental to the Human

Both creativity and reverence took center stage at the Great Exhibition of 1851, an industrial world's fair held at the purpose-built Crystal Palace in Hyde Park, London. Though the British colonies as well as other Western countries contributed, much of the exhibition focused on British industrial dominance, for which presenters credited mechanization. The event became synonymous with British pride and Victorian extravagance. The displayed items included raw materials, domestic appliances, scientific and medical equipment, jewelry and metalwork, and, most popularly, industrial machines. Some of these machines were stationary and some were displayed in motion, the latter of

which particularly captivated the crowds. The author of one exhibition guide introduced this category by praising the ubiquity and versatility of steam power. He claimed with wonderment that steam could make something desirable of every aspect of the natural world, equally capable of cutting metal and propelling ships through the sea as of spinning delicate threads and printing patterns on cloth. In sum, it "armed the feeble hand of man…with a power to which no limits can be assigned."[2] Exhibition audiences shared the author's fascination: he noted that crowds were gathered around the machines at all times, "viewing them with a curious and intelligent interest, and although half deafened by their noise, apparently yearning after information as to the principles of their structure and operation."[3]

The exhibition guide's author attributed to machines the ability to control the environment, an ability they extended to human beings. They took the raw materials of nature and worked them into useful, orderly, and sometimes beautiful products, and for this they were worthy of reverence. The author described steam power as omnipotent, referring to its physical strength but also carrying connotations of godhood. This choice of words invests machines with a supernatural character; contrasting mechanical strength with human weakness amplifies this impression. The phrase "armed the feeble hand of man" evokes Michelangelo's *The Creation of Adam*, in which God reaches out to the frail, newly made Adam and imbues him with the spark of vitality. Whether or not the author intended the allusion, this is a reverential phrase that subordinates humanity to technology. It suggests that machines – and notably not inventors – are humanity's aids at the least and its saviors at the most.

The author's depiction of the Great Exhibition's audience is also noteworthy. Observers viewed the machines with awe and curiosity, and they were eager to learn how the devices worked. From this description, it can be inferred that few in attendance were engineers or intellectuals, but rather members of the general public. Though their attitude toward the machines could not quite be described as reverential, it was certainly awestruck. Machines were a spectacle, to borrow a term from Herbert Sussman's analysis of the Great Exhibition: practical inventions but, more importantly, things to be marveled at for their cleverness and sense of autonomy.[4] This description suggests that machines enthralled not only industrial advocates and inventors, but a broader swath of English society. Because machines embodied ingenuity and command of the natural world, their attraction was just as great for those who knew nothing about them as for those who knew them well.

The Great Exhibition's attendees were not the only lay people to be captivated by machines. A similar reverence for machines and the order they imposed can be found in *Notes of a Tour in the Manufacturing Districts of Lancashire* by journalist William Cooke Taylor. This work was first published in 1842, almost a decade before the exhibition. Written in the style of a travel diary, *Notes* consists of a series of letters to the Archbishop of Dublin, which contain Cooke Taylor's observations of the Lancashire textile factories he visited. He described *Notes* as an objective discussion of the factory system, refraining from the rhetorical excess that characterized so much of the factory debates in the early to mid-1800s.[5] However, the language Cooke Taylor used to characterize machines was far from neutral. Beginning early in this work, he endowed machines with the same inevitability and irresistibility as Charles Knight did almost a decade earlier. "It exists," he wrote, "and must continue to exist; it is not practicable, even if it were desirable, to get rid

of it…."[6] Moreover, although he admitted to the existence of exploitative employers and badly run factories, his overall treatment of machines was positive. Like some of his contemporaries, he established machines' sublimity early on with an origin story drawn from Greco-Roman myth:

> The steam engine had no precedent, the spinning-jenny is without ancestry, the mule and the power-loom entered on no prepared heritage: they sprang into sudden existence, like Minerva from the brain of Jupiter, passing so rapidly through their stage of infancy that they had taken their position in the world and firmly established themselves before there was time to prepare a place for their reception.[7]

This is not quite accurate; in fact, historian Eric Hobsbawm has argued that early industrial machines were not extraordinary in design, only in the large-scale effects they produced.[8] Though steam-powered machines were much more powerful than their predecessors, they evolved from manually operated devices like the spinning wheel and the hand loom. Nonetheless, Cooke Taylor perceived machines as objects of reverence to be celebrated for their exceptionality. In his view, steam-driven machinery was unlike any other invention in human history. It had "no precedent," coming fully formed into the world as a revolutionary force so swift and powerful that its own creators could not keep pace with the changes it brought. The comparison to Minerva (the Roman counterpart of Athena), who was born fully grown, underscores the rapid innovations in textile machinery and adds a mythical dimension to mechanization. Minerva is associated with wisdom as well as commerce. This allusion creates the romantic sense that Minerva acted as a divine patron of manufacturing, inspiring the human engineers who brought machines into the world.

Cooke Taylor's assessment of machines' rapid advent indicates that machines brought chaos, not order, and Cooke Taylor was aware of this possible interpretation. Early in *Notes*, he acknowledged the nineteenth-century perception that "there is something in

the character of manufactures which is unnatural, and opposed to the will of God."[9] Although he did refer to the factory system as a "giant" and a "stranger" that "extends pain and disturbance to its remotest extremity," this moment of dissonance is exceptional.[10] For the rest of *Notes*, Cooke Taylor presented machines as a natural result of human advancement that did not work against nature (human or otherwise) but for its betterment. They might disrupt society upon their introduction, but they ultimately brought stability. Far from ruining the Lancashire countryside, Cooke Taylor reported that the introduction of machinery had curbed the wildness of nature and transformed it into a paradise. Indeed, "it is to manufactures that this district is indebted for the moors blooming as the garden, and the desert blossoming as the rose."[11] Had textile factories not been introduced into Lancashire, then, there would have been no workers to live there and no reason to tame the wilderness. The land might have remained uncultivated and unrefined forever. Instead, it became a sort of Eden to serve the needs of workers and machines alike. Here, mechanical installations seemingly did not mar the landscape and darken the skies with smoke, but instead beautified nature by turning it to a useful purpose.

This interpretation of mechanization aligns with Erasmus Darwin's *The Botanic Garden*, although *Notes* was written half a century later. Both Darwin and Cooke Taylor characterized machines as collaborators with nature, not opponents of it. Although they acknowledged that machines used nature for their own purposes, neither depicted this as malicious subjugation or wanton exploitation. Instead, machines were governing forces given life by human ingenuity, bringing order to chaos. Also noteworthy is that the Edenic imagery of "the desert blossoming as the rose" comes from Isaiah 35:1, which promises that God will lead the Israelite exiles to paradise. Here the textile mills and their machines

were God-given aid, bringing industry to what was once a purposeless wasteland and sustaining the workers who lived there. This underscores the persona of the mythical – or in this case biblical – machines Cooke Taylor established early in *Notes*. They were not only clever inventions but blessings from God.

For Cooke Taylor, machines imposed order not only on nature but on human beings as well. He referred to workers as "tenters," an early nineteenth-century word derived from Scottish and northern English roots meaning "to heed" or "to pay attention."[12] This word connotes self-control on the part of the workers. They had to be vigilant and watch for problems at all times, a role that demanded mental discipline. Unlike manual laborers, they also had to adhere to mechanical rhythms rather than setting their own. Shortly after his use of "tenters," Cooke Taylor noted that "all persons engaged in a mill are subject to the control of a power able to mediate between them with equal fairness and authority.... The steam-engine is the most impartial of arbitrators...."[13] Thus, the steam engine's imposition of order ostensibly benefited everyone in a factory. It kept the employer and the employed on equal footing, as they all depended on the machine for their working rhythms and their livelihood.[14] Though the steam engine's authority was benign, it was absolute. The workers were its subjects: the engine governed them, and in return for their obedience, it provided them with the means of earning a living. As we will see, Cooke Taylor's line of reasoning contrasts sharply with that of factory reformers and physicians, many of whom raised concerns regarding repetitive motion injuries and the mental degradation of long working hours.

Cooke Taylor viewed mechanical rule of the factory as a gift, and he held machines blameless for all the suffering that might arise from the giving. Throughout *Notes*, he

attributed the hardships associated with the factory system to a wide range of issues: the criminality of rural migrant workers, Chartism and Ten-Hour agitation, international tariffs and domestic taxes. He went so far as to say that child factory labor was a lesser evil than the poverty that forced working parents to send their children into the workplace to begin with.[15] He firmly believed that if the government were to take a laissez-faire approach to industry, eschewing regulatory legislation, employers would then have leave to combine their interests and provide better environments for their workers.[16] He also praised the familial atmosphere of the well-run mills he saw in the countryside, though he noted elsewhere that such amiable relations between employers and employees were not found in overcrowded cities like Manchester. [17] Though Cooke Taylor was not wrong to suggest that high taxes and the now-infamous Corn Laws contributed to poverty, he conspicuously exempted machines from his considerations. Nowhere did he address the mass displacement of handworkers by mechanical spinners. Like Knight, he simply considered machines an inevitability, albeit a beneficial one, and accepted that some suffering must be endured for the sake of ultimate good. For him, the costs of mechanization were temporary, while the blessings – order, stability, discipline – were so great and lasting as to warrant adoration.

4.2 Ordering the Chaos of Human Imperfection

Arguments like Cooke Taylor's are found in Sir Edward Baines's *The History of the Cotton Manufacture in Great Britain*, first published in 1835. In this work, Baines traced cotton production to antiquity, then explored its route to continental Europe and Britain. In keeping with the imperialistic spirit of the times, Baines attributed the perfection of cotton manufacturing to England, rather than to India where he stated it originated in

hand-powered form. In his view, the Indian character was too "indolent" to pursue technological progress as the English did.[18] More important to this discussion, however, is Baines's characterization of machines. Although less effusive than some of his contemporaries, Baines nevertheless approached machines with a distinct sense of awe. Indeed, he quoted the verses from Erasmus Darwin's *Botanic Garden* discussed previously, which suggests Baines too perceived an almost supernatural life in this new technology.[19]

The reason for Baines's admiration at first appears similar to Charles Knight's: both men saw machines as labor-saving tools. Baines went further, however, hinting that steam-powered machinery had not only eased human burdens, but taken the work almost entirely upon itself, superseding human hands in speed and dexterity. He concluded his discussion of cotton-spinning and weaving thusly:

> It is by iron fingers, teeth, and wheels, moving with exhaustless energy and devouring speed, that the cotton is opened, cleaned, spread, carded, drawn, roved, spun, wound, warped, dressed, and woven…Men, in the mean while, have merely to attend on this wonderful series of mechanism, to supply it with work, to oil its joints, and to check its slight and infrequent irregularities…[20]

Later, Baines directly refuted the reformer James Kay-Shuttleworth's concern that workers had been subjugated to a power far stronger than they, using language from Kay-Shuttleworth's *The Moral and Physical Conditions of the Working Classes*.

> Instead of the workmen being "drudges," it is the steam-engine which is *their* drudge… All the precision, power, and incessant motion belong to the machines alone, and the work-people have merely to…piece the threads broken by the mechanical spinner.[21]

These passages echo Knight's attempts to euphemize mechanization. Like Knight, Baines presented machines as "drudge[s]", tools to be wielded, subject to the human will. Yet also like Knight, Baines did not entirely conceal the full implications of mechanized manufacturing. This quotation makes plain that steam-powered machines did not work

with humans but in place of humans. Though Baines may have intended otherwise, the phrases "supply it with work," "oil its joints," and "check its slight and infrequent irregularities" do not imply human mastery of machines. The line between servant and master, for all that Baines attempted to clarify it, blurs when observed through his lens. The question becomes whether the mechanical servant could truly be called a servant when it had superseded its human counterparts in terms of speed, power, and skill, and required them only to tend to its needs and watch for errors. Machines performed the work – magnanimously, Baines suggested – but in giving over so much of their labor to their mechanical substitutes, the workers forfeited their autonomy.

Baines did not explicitly advocate for the elimination of human labor, but he did find machines to be the superior workers. His admiration for machines stemmed from the order and discipline they brought to factories. His description of mechanical irregularities as "slight and infrequent" carries an implied contrast between the consistency of mechanical labor and the variability of handwork. By eliminating human beings, that variability and indiscipline would also be eliminated. The phrase "mechanical spinner" suggests that Baines believed this was indeed the direction of technological progress. Had Baines written "a spinning machine," or "a machine for spinning cotton," the connotation would have been different. Such phrases would indeed have described machines as tools, designed for and set to a specific purpose in the service of human beings. Instead, Baines employed the word "spinner," a title which, until the onset of industrialization, was reserved for human artisans working with hand-powered equipment. Baines used this title elsewhere, describing Samuel James Hargreaves's multi-spindle spinning jenny as "an *eight-handed* spinster."[22] The use of these occupational titles gave machines all the agency

and reduced workers to the status of unskilled or semi-skilled attendants, again calling into question Baines's assurance that human beings had not become the drudges of a more disciplined, more powerful entity.

Baines later provided an even clearer suggestion of his belief that human labor would soon be supplanted by the mechanical. It too involves the word "spinner," this time in its human context. In concluding his description of recent innovations in textile machinery, Baines wrote, "Finally, to consummate the wonder, Roberts dismisses the spinner and leaves the machine to its own infallible guidance."[23] This statement refers to the Roberts loom, an automatic machine that required little or no intervention from the operator. Here, quite explicitly, the human spinner was sent away, replaced by an "infallible" mechanical counterpart. Baines's characterization of machines, then, was not that of servants, but of entities superior to human beings in power and skill. They were perfect in design, subject to no disorder, and therefore worthy of reverence.

4.3 Sacred Logic: Charles Babbage and Machines as Models of Divinity

No less devout than Baines's work is Charles Babbage's *On the Economy of Machinery and Manufactures* (1835). In this treatise, Babbage described various manufacturing processes, demonstrated the ubiquity of machinery, and discussed efficient factory organization, while also subtly promoting machine veneration. As a mathematician, inventor, and engineer, Babbage had a thorough understanding of nineteenth-century machinery, and he looked upon it with a quiet but pervasive admiration. Like many of his contemporaries, he was fascinated by the order and independence inherent in machines like the self-regulating steam engine. He wrote that for machinery to work efficiently, its speed and power must be held constant, and one well-known device for doing so was "that

beautiful contrivance, the governor of the steam engine; which must immediately occur to all who are familiar with that admirable machine."[24] The words "admirable" and "beautiful" recur elsewhere in this work, most notably in a discussion of how mechanical combinations could be used to perform complex tasks. In Babbage's view, the "more beautiful combinations" of machinery were "exceedingly rare. Those which command our admiration equally by the perfection of their effects and the simplicity of their means, are found only amongst the happiest productions of genius."[25]

Babbage was not entirely immune to the extravagance which characterized other defenses of industry. Such awestruck language is rarely found in *The Economy of Machinery and Manufactures*, but where it does occur it demonstrates that Babbage was as delighted by mechanization as more romantic industrial advocates. For one brief moment, he put aside prosaic discussions of engineering and depicted the steam engine as "obedient to the hand which called into action its resistless powers."[26] It drove the devices that made rigging and cables to "[contend] with the ocean and the storm, and [ride] triumphant through dangers and difficulties unattempted by the older modes of navigation." Steam-powered textile machines, "with almost fairy fingers, entwine the meshes of the most delicate fabric that adorns the female form."[27] These personae – the dutiful servant, the aid of humanity, the supernatural artisan – are recurrent features of machine veneration, seen in both Cooke Taylor's and Baines's writings.

Babbage was not content merely to praise the power of steam or the splendor and skill of machines, however, or even the prestige they brought to Britain. When he spoke of mechanical beauty, he spoke most often as an engineer. The beauty he saw arose not from any hints of supernaturality, but from the unity of form and function, the bringing together

of many disparate parts for a singular purpose. The machines he found most pleasing were those that produced high-quality goods by the simplest, most elegant means. Babbage based this characterization, the "beautiful contrivance" or "beautiful combination," entirely on engineering, and unlike many other writings, he did not often utilize anthropomorphism or the trope of technological sublimity. In his interpretation, machines had no inner life or will; they were simply the products and the embodiments of logic, and Babbage revered them for this alone. Through the genius of inventors, machines brought order to manufacturing and refinement to the raw produce of nature. They were, in sum, cleverly designed tools, and the cleverer the design – the better suited the form to the function – the more beautiful the machines.

Although Babbage wrote as an engineer, he did not divorce machines from the divine. He elaborated upon these beliefs in *The Ninth Bridgewater Treatise* (1837), a work which, with its discussions of scriptural literalism, the existence of miracles, and the relationship between science and religion, could occupy an analysis of its own. Babbage's theory of how the creative power and governance of God might be understood also constitutes a unique aspect of machine veneration. To explain his philosophy, he used his own invention, the calculating engine, as an object lesson. Babbage conceived three such engines in his lifetime. Due to funding shortages and conflicts with his chief engineer, he never saw any of them completed, but the Science Museum of London built a model of Difference Engine No. 2 in 1991 using Babbage's specifications. It ran, and continues to run, precisely as he described.[28]

The most advanced of the three Babbage engines was the Analytical Engine, essentially a mechanical computer. It automatically calculated mathematical functions

according to "programs" on punch cards, an idea borrowed from the Jacquard loom, which used instructions encoded on punch cards to weave patterns into fabric. The Analytical Engine was capable of addition, subtraction, multiplication, and division, as well as more complex operations, and it impressed its results into trays of soft material to be used in print reproduction. The aim was to produce accurate tables of values that eliminated human error, reduced the time spent on calculation, and served as references for those in need of such precise information, such as engineers. Though multiple nineteenth-century authors described machines as having a semblance of life or even thinking for themselves in a figurative sense, Babbage's calculating engines most nearly approached this in actuality. The concept of the thinking machine is commonplace today, both in fiction and in modern technology, but it was groundbreaking and even unsettling in Babbage's time. If machines could think, his contemporaries wondered, were humans as unique as previously believed? Where did thought originate: in the soul or in the body? Intellectuals like Ada Lovelace, a nineteenth-century mathematician who described Babbage's inventions as "reasoning machines," prompted many to reconsider their ideas of consciousness, the soul, and the workings of God.[29]

Babbage set forth his own answers to these difficult questions in *The Ninth Bridgewater Treatise*, using his calculating engines as guides. In doing so, he created a striking machine persona: the machine as allegory for the nature of God. Specifically, Babbage saw a parallel between the workings of his calculating engines and the manner in which God might govern the universe. He wrote that these engines could be preset such that they produced a series of numbers according to one pattern for a fixed duration, then changed to a different pattern. For example, the preconditions might be set such that the

calculating engine counted by ones up to 100,000,000, then began counting by ten thousands.[30] To an observer unaware of the preconditions, it might seem that the rule governing the succession of numbers had changed, but in reality, these two specific rules – counting by ones and counting by ten thousands – were part of a broader and more complex law complete with built-in alterations. As Babbage described it, the calculating engine "must be susceptible of having embodied in its mechanical structure, that more general law of which all the observed laws were but isolated portions – a law so complicated, that analysis itself, in its present state, can scarcely grasp the whole question."[31]

Babbage applied this thinking to the universe itself: it was a machine designed by God that ran according to infinitely complex rules, with built-in changes enacted automatically at the appropriate time. Babbage explained evolution and natural selection, soon to be described by Charles Darwin, in the same way. These and other changes to the planet were part of God's pre-programmed design for the universe. "To change…after lengthened periods, the races which exist…by allowing the natural extinction of some races, and supplying by a new creation others more fitted to occupy the place previously abandoned," was built into the preconditions God set for the world much as changes in counting methods were built into the calculating engine.[32] Divine miracles could be similarly explained. They appeared miraculous, Babbage argued, because human beings could not perceive the full extent of the universe's programming. People grew accustomed to what they believed were unchanging laws and thus were startled when a change occurred:

> The engine…may be set, so as to obey any given law; and, at any periods, however remote, to make one or more *seeming* exceptions to that law. It is, however, to be

> observed, that the *apparent* law which the spectator arrived at…is not the full expression of the law by which the machine acts; and that the excepted case is as absolutely and irresistibly the necessary consequence of its primitive adjustment, as is any individual calculation amongst the countless multitude it may previously have produced.[33]

In the terms of this analogy, miracles represented momentary alterations to the workings of the divine machine, after which the machine continued to run according to the previously established law. As Babbage cautioned, however, this established rule was only an "apparent" law: it was but one piece of the grander programming.

The assertion embodied by this philosophy – that machines could be used to explain the divine – is a singular one. Other authors wondered at the machine's apparently supernatural power, aligned it with nature spirits and Greek deities, even argued that machines arose from the God-given spirit of invention. Babbage too saw links to divinity in machines, but his presentation lacked the overindulgence of his contemporaries. *The Ninth Bridgewater Treatise* was not an exultation of machine power or a thinly veiled argument for the elimination of human workers and their unions. It was a philosophical discussion that attempted to bridge the realms of faith and science using the calculating engine as an intermediary, through which Babbage arrived at the perception of God as a divine programmer or inventor. To him, the order inherent in machines was a microcosm of the order inherent in God and the universe, and that made machines worthy of reverence.

More broadly, Babbage argued that although human beings would never fully understand the formulae that constituted the workings of the universe, they could approach such an understanding through machines, which emulated, however feebly, the workings of God. In an article on *The Ninth Bridgewater Treatise*, Tamara Ketabgian described this philosophy as "prosthetic divinity." She noted that Babbage perceived human minds and

senses as inherently limited, requiring the aid of technology to comprehend the divine.[34] Although Babbage argued that no human invention could ever amount to more than a pale imitation of God's creations, he hoped that through such inventions, "we may perhaps be enabled to form a faint estimate of the magnitude of that lowest step in the chain of reasoning, which leads us up to Nature's God."[35] For authors such as Cooke Taylor and Baines, machines deserved reverence because they imposed order on both the human and non-human aspects of the living world. Babbage went further. He found in mechanical programmability, infallibility, and logic an allegory for God. This, surely, was the apex of machine veneration.

4.4 False Idols: Challenges to the Perception of Machine-Made Order

Lovers of machinery used reverential language to praise machines for bringing stability and prosperity to society, but critics and reformers turned this language on its head. They alluded to biblical or mythical figures not to deify machines, but to decry their dangerous, disordering influence. Quite in contrast to Charles Babbage, reformers saw in machines the sorts of idols against which the Bible warned. An address by a group of cotton spinners from the town of Preston in Lancashire provides an example. In this fiery appeal for labor activism, the authors gave mechanization religious significance by using biblical metaphors. Factories, they wrote, were "the modern temples of Mammon."[36] *Mammon* derives from Aramaic, referring to material wealth and the idolatrous worship of money. This view of machines as instruments of capitalist greed was not unusual, but the authors made further, harsher condemnations. In stark contrast to Charles Knight and F., who saw machines as the driving force of enlightenment, these activists painted mechanization as a return to a lawless past. Machines, to them, were akin to the Old Testament god Moloch,

who required child sacrifice.[37] This clearly refers to child labor, which working-class poverty often necessitated.

More significantly, the authors believed machines and the factory system were antithetical to Christianity, and that anyone who practiced labor exploitation could not claim to be a Christian. Factory regulations were still ineffective at the time of this address, and long working hours deprived children of both secular and religious education, health, and innocence. The authors found this an abhorrent situation. "Is this not heathenism?" they asked. "Is not barbarism itself refinement to this, and not Paganism divine when compared with such 'Christianity' as this?"[38] This directly refuted writers like William Cooke Taylor, who alleged that in Lancashire, where he made his tour of cotton mills, the hardships of factory life turned the workers towards piety and prayer.[39] Indeed, Cooke Taylor's perspective remained contentious well beyond the nineteenth century: historian E.P. Thompson has argued that the manufacturing class utilized the Christian concept of poverty as a holy state to maintain workers' submission.[40]

Other critics of machinery used the language of the unstoppable titan not to argue for machines' regulating, disciplining influence, but for the opposite. Though they stood in awe of the scale, power, and seeming inevitability of mechanization, they also denounced its socially disruptive effects. James Kay-Shuttleworth was a prominent voice in this group of workers' advocates. He was involved in various charitable endeavors throughout his life, including the founding of a college that specialized in training teachers to serve impoverished children. As a physician, he was also interested in public health. Among his best-known works is his report on the working population of Lancashire, *The Moral and Physical Condition of the Working Classes* (1832), in which he drew upon his medical

training to assess the health of the county's factory operatives. Notably, this work influenced Friedrich Engels's well-known study of Manchester's working poor, *The Condition of the Working Class in England* (1845).

In contrast to Cooke Taylor, Kay-Shuttleworth did not find workers living idyllic rural lives governed by the strict but gentle machine. Instead, he set the language of the titan to a new purpose and presented the machine persona that so irritated Edward Baines:

> They are drudges who watch the movements…of a mighty material force, which toils with an energy ever unconscious of fatigue. The persevering labour of the operative must rival the mathematical precision, the incessant motion, and the exhaustless power of the machine.[41]

Unlike Baines, who portrayed machines as both the servants and superiors of human workers, Kay-Shuttleworth was unambiguous as to this relationship. He made no attempt to depict machines as harmless tools or even benevolent authorities; they were only grinding, unfeeling forces. The regulation they imposed on operators was so harsh that it produced the opposite of order. Machines and their "incessant motion" set impossible standards that degraded workers who tried to meet them mentally, physically, and morally.

Although Kay-Shuttleworth did endow machines with some semblance of life, it was an inhuman semblance. The "soft lips" and "fine fingers" of Erasmus Darwin's cotton-spinning machines, the mechanical devices which seemed almost to kiss the cotton and comb the tangles from it as from a child's hair, were nowhere to be found in Kay-Shuttleworth's machine persona. Kay-Shuttleworth's machines were superhuman leviathans as much as Darwin's, Knight's, and the *Dublin Penny Journal*'s, but they were not leviathans whose power ought to be venerated. They were not leviathans capable of gentleness as well as supernatural force. They were rivals that workers could not hope to defeat, forcing laborers to fight a losing battle until they had no more strength to do so.

Moreover, Kay-Shuttleworth noted that mechanization disordered not only working life, but also interpersonal affairs, reducing the capacity for individuals to see one another as human beings rather than means to an end. He rejected the notion that the human experience of life and labor could in any way be described in mechanical terms; instead, he perceived society – not the factory system – as a living organism. "The social body," he wrote, "cannot be constructed like a machine, on abstract principles which merely include physical motions, and their numerical results in the production of wealth."[42] In other words, both social and economic affairs had a vital human component. To ignore this was to reduce complex interactions and stifle effective solutions to working-class struggles. Treating productivity as the overriding objective reduced human beings to the "animal power necessary to the mechanical processes of manufacture."[43]

Kay-Shuttleworth attributed several aspects of social disorder to mechanization. Far from sharpening the mind, as Cooke Taylor argued, Kay-Shuttleworth believed that factory work provided no mental or moral stimulation and thus eroded workers' self-respect. This erosion combined with poverty to manifest in unhealthy, overcrowded housing, poor hygiene, and criminality.[44] Such conditions bred social unrest, which sometimes became violent. The factory system also degraded family bonds. Children suffered the most, the neglected victims of their parents' long working hours and poverty.[45] Finally, the lure of factory work changed the demographics of manufacturing cities, bringing newcomers whom Kay-Shuttleworth considered undesirable. Subject to the prejudices of his time, he ascribed the apparent immorality of the working classes to the influence of Irish immigrants, arguing that Irish laborers set a bad example for the English.

They ostensibly encouraged English workers to spend wages on alcohol and other passing pleasures rather than putting them into savings or purchasing necessities.[46]

Like many of his counterparts on the opposite side of the factory debates, Kay-Shuttleworth believed that one remedy to machine-induced disorder was free trade. Indeed, he quoted from Charles Knight's *The Results of Machinery* in concluding that if broader markets were established to suit the production capacity of new machines, joblessness would be alleviated.[47] With this problem in hand, human beings could master their new technology to the benefit of all rather than losing social stability to poverty and exploitation. Despite his concerns regarding the detrimental effects of machinery, Kay-Shuttleworth's view aligned with the *Dublin Penny Journal*'s: machines needed the economic space to exert their influence, or else flooded markets and deprivation resulted. The problem was not solely one of mechanization, but of a market economy that had not adapted to meet the demands of the rapidly advancing mechanical age. Although Kay-Shuttleworth warned against prioritizing economic motives over human ones, he recognized that the two were intertwined, and machines must be given their due.

The reformer and physician Peter Gaskell, whose 1836 work *Artisans and Machinery* will be discussed more extensively in the next chapter, also employed the image of the titan. Specifically, he drew on mythological allusions and religious appeals to argue that if machines must be seen as gods, they were treacherous, destabilizing gods undeserving of worship: "Already [the laborer] is condemned…to feel that he is but a portion of a mighty machine, every improved application of which, every addition to its Briareus-like arms, rapidly lessen his importance…."[48] In Greek mythology, Briareus was the leader of the three Hecatoncheires, hundred-armed giants and faithful allies of Zeus in

the fight against the Titans. Industrial advocates also drew the same comparison: Baines, for instance, referred to Samuel Crompton's hundred-spindle spinning mule as a "Briarean power."[49] In his usage, this allusion reinforces the mythical nature of machines and lauds their great dexterity and power. More subtly, it underscores how dutifully machines served industrialists, like Briareus the friend of Zeus – far more dutifully, it is implied, than human workers. Gaskell did not share this belief in machines' quasi-divinity, and in his writing, the title "Briareus" takes on darker connotations. Gaskell saw the hundred hands of Briareus not as aids, but as monstrously powerful rivals to the laborer's two hands, ready to snatch away the work that should belong to human beings.

Like Knight and Cooke Taylor, Gaskell also compared the human body to a machine. Gaskell's contemporaries, however, did this to make mechanization seem natural and unthreatening, thinly veiling their hopes that human variability might be eliminated from the labor equation. Gaskell's use of this comparison, on the other hand, makes clear his belief in the superiority of the human body over the mechanical one. In a chapter on child labor, he argued that the human body and the human life cycle were both designed by God, designs innately more perfect than any earthly invention. To Gaskell, growth was a divinely ordained process, and manufacturers ought not to interfere with its inherent wisdom by employing children in ways that did not suit – indeed, that damaged – their developing bodies and minds. "The Divine Architect," he wrote, "whose omniscience has contrived a mechanical apparatus like the human body, has also, in the mode of its growth…clearly indicated the order into which their functions should be called into employment."[50] Far from bringing order, machines interfered with God's own preordained, logical system of growth.

It is unclear whether Gaskell intended this passage as a critique of authors like Baines, who revered mechanical technology, but it functions as such. Gaskell pointedly reserved his reverence for God, the creator of the perfect "animal machine," not for any human invention or inventor.[51] His use of the term "Divine Architect" suited the mechanical age in which *Artisans and Machinery* was published, establishing God as the ultimate inventor to whom all human creators owed their gifts and their lives. This notion refuted the quasi-deification of machines and their inventors perpetuated by industrial advocates. Gaskell expanded upon this theme later in *Artisans and Machinery* when he attributed the irreligiosity of the factory population to isolation from nature. For Gaskell, God was revealed in the natural world, yet the factory worker "…knows nothing of nature – her very face is hidden and obscured from him, and he is surrounded and hemmed in by a vast circle of human inventions."[52] The factory system thus prevented workers from experiencing and understanding God, offering them instead the false idols of machines and machine-makers.

Gaskell's perception ran contrary to that of many of his contemporaries, particularly Charles Babbage. Babbage believed that God and the workings of the universe could best be understood through a mechanical model. In machines he found a miniature representation of divine governance, but from Gaskell's perspective, that governing order was superficial, confined to the realm of engineering. Gaskell saw that beyond this physical neatness, beyond the almost sacred elegance Babbage perceived in mechanical combinations, machines inflicted great chaos on society: broken families, upended social norms, health hazards, and wide-ranging squalor. Instead, he found a deeper and more perfect order in nature as laid out by the "Divine Architect." Babbage experienced the

creative logic of God through machines, and for that they earned his reverence, but to Gaskell, Babbage and those like him bestowed their reverence on precisely the wrong objects.

CHAPTER V

THE ALLURE OF MECHANICAL POWER

In 1824, a group of engineers and members of Parliament met in London to discuss the erection of a monument to James Watt, who greatly increased the steam engine's efficiency and made it the ubiquitous driving force of factories and locomotives. The committee members offered many lavish tributes to Watt and his contributions to engineering, but they gave equal praise to steam engine itself. In particular, the device's great power enthralled: such a mechanical force, so strong, so well-directed, and so varied in its applications, seemed too perfect to be real. Indeed, it left the committee members searching for words to express their awe. "Upon the nature of this power," wrote committee chairman C.H. Turner, "I can hardly venture to speak: so extensive and magnificent a subject demands a more accomplished and able orator."[1]

In the end, the committee members did find vivid words to describe steam power, as did other industrial advocates and reformers alike. Both parties wrote of machines in grandiose, awe-filled language, recognizing the significant implications of mechanization, though for reformers, that awe was colored with fear rather than reverence. The attitudes of the advocates presented here closely resemble those in the previous chapter: they considered mechanization the key to an idyllic future, they believed machines would bring

order and prosperity, and they wrote with great wonder and admiration. However, their wonder had broader scope than that of their contemporaries. They fused the previous three characterizations explored in this thesis – the machine as instrument of labor, the organic or living machine, and the machine as bringer of order – to create an image of mechanical power that transcended the physical and crossed into the sublime. Unlike Charles Knight and F., who both hinted at such an image, these authors made no comparisons to handheld tools, no attempts to conceal machines' influential nature beneath a thin veil of mundanity. Instead, they cast that veil aside, openly and wonderingly celebrating mechanical power as the greatest triumph of the age.

5.1 Power Perfected

Andrew Ure's *The Philosophy of Manufactures* (1835) represents the zenith of this characterization. A Scottish physician and professor of physics, Ure had an academic knowledge of engineering, but *The Philosophy of Manufactures* is as much a paean to machinery as a technical manual. Ure drew upon all the characterizations discussed in the previous chapters in his depiction of machines as perfect beings, entities that combined mechanical utility and strength with lifelike dexterity and unflinching discipline, resulting in a form of power entirely their own. Like many of his contemporaries, Ure recognized the implications of such power for reducing human labor and advancing Britain's global status, but he did so in such grand terms that at times he lifted machines from the mundane world of economics and into the lofty world of liberation.

Like Erasmus Darwin, Ure conceived mechanical power as a living power. He compared a well-run factory to a healthy human body, with the shafts and gears as "the grand nerves and arteries which transmit vitality and volition, so to speak, with due

steadiness, delicacy, and speed, to the automatic organs."[2] Alternatively, a badly organized workplace was like a person suffering from a neurological disease.[3] Further, Ure described machines using the words "automaton" and "android."[4] Though these words are popularly associated with science fiction, with their connotations of sapient artificial intelligence, their origins are much older. Both words derive from Greek and Latin, "automaton" meaning "acting of itself," and "android" meaning "man-like."[5] Humanoid automata did indeed exist in Ure's day: Ure himself wrote of a mechanical flute player built by the French inventor Jacques de Vaucanson, which could imitate human breath control and play no fewer than twelve different songs "with equal precision and taste."[6] However, Ure also used "android" to refer to machines that, though not physically resembling humans, performed human labor. This was a suitable term to describe the automatic textile machines of the nineteenth century, which performed the formerly human task of cloth-making with little or no intervention.

Steam-powered machines were automata in a strictly mechanical sense, but the phrase "acting of itself" could be interpreted as an implication of will, particularly given that Ure wrote at a time when industrial advocates often flirted with the idea of mechanical agency in their writings. However, Ure suggested the opposite throughout *The Philosophy of Manufactures*: namely, that machines did not have a will, and that was precisely what made them so desirable to employers. In one early passage, Ure summarized the adjustments that workers would have to make if the factory system were to prosper:

> The main difficulty did not, to my apprehension, lie so much in the invention of a proper self-acting mechanism for drawing out and twisting cotton…as…above all, in training human beings to renounce their desultory habits of work, and identify themselves with the unvarying regularity of the complex automaton.[7]

This passage reveals Ure's conception of living power: it imitated life only in its capacity to perform human tasks; it carried no suggestion of thoughts or feelings like Darwin's gentle spinner or curious water pump. If human laborers were to be productive under such a system, Ure argued that they must become as mechanical as Vaucanson's flute player, as steady and regulated as steam engines and textile machines. This quotation also suggests that handworkers struggled to turn a profit not entirely because of mechanical competition, but because they lacked consistency and discipline. In a factory, machines dictated the pace, but artisans were accustomed to setting their own rhythms, which made it difficult for them to adapt to factory life. Moreover, Ure's use of the word "desultory," meaning unenthusiastic or casual, implies that workers had too much liberty for their own good, too much autonomy over their own labor. Without mechanical intervention, Ure implied, they could work whenever they wished, and they could become lazy or preoccupied by more interesting pursuits. Machines were the cure for these supposed ills. Ure saw mechanical power as perfect precisely because it had no animating will; at most, machines' behavior suggested to him a limited sense of purpose wholly devoted to labor and subject to no distraction. The machines of *The Philosophy of Manufactures* were, much as William Cooke Taylor described them, impartial arbiters.

Ure praised mechanical power because its application was purposeful, and it could thus instruct and perfect human workers. By the example of their own unwavering use of power, machines corrected laborers' "desultory" behavior and formed them into disciplined beings much like machines themselves. Ure's ideal factory, therefore, combined what he perceived as the best of the human and the mechanical: humans provided dexterity while machines provided strength and regulation, and both parties worked

together with little differentiation. Nor was this Ure's most effusive praise of mechanization, as demonstrated by the origin story he devised for manufacturing: "…Providence has assigned to man the glorious function of vastly improving the productions of nature by judicious culture, and of working them up into objects of comfort and elegance with the least possible expenditure of human labour."[8] Here, the factory system and its machines, which refine the raw materials of nature into useful and beautiful products, are the results of a divine mandate to improve upon creation itself. Though machines are not divine themselves in Ure's interpretation, they bear God's signature as the products of a God-given spark of creativity.

Ure was not the first to depict machines in this way: Charles Knight did the same, though in his case it was only a glimmer beneath the mask of mundanity. Ure brought this depiction into the open, not escaping romanticism despite his praise for the unerringly scientific operation of the factory. In his vision, "[t]he benignant power of steam summons around him his myriads of willing menials…substituting for painful muscular effort on their part, the energies of his own gigantic arm, and demanding in return only attention and dexterity."[9] In this passage, the power of steam is not only a living power, but it has a distinct character. It is a ruler, endlessly strong but gentle, relieving its subjects of an onerous burden and asking only discipline in return. The machines of *The Philosophy of Manufactures* are the opposite of the monstrous juggernauts portrayed in reformist writings. They are not colossi to grind their servants into the dust, but monarchs who condescend to use their might for their people's benefit. Indeed, Ure claimed, they are so gentle and "so self-regulating that a child may superintend [them]," and they leave workers almost entirely at ease while they carry out their work in a "masterly manner."[10] Even less

fanciful passages than this one convey a sense of supernatural perfection. Ure wrote that on his tours through machining works, he was "frequently at a loss…to know whether the polished shafts that drive the automatic lathes and planing machines, were at rest or in motion, so truly and silently did they revolve."[11]

Here again, Ure did not praise power for its own sake, but for the relief it afforded the workers whose burdens it ostensibly lifted. However, as suggested in the passage discussed above, wherein Ure indicated that human workers should strive to become like machines, Ure was a devotee of automation and sympathetic to manufacturers' needs. The reduction of human labor as he saw it constituted relief in more than one sense: it aided workers by limiting their exertion, but it also rescued employers by limiting workers' involvement. This theme appears throughout *The Philosophy of Manufactures*, but rarely more clearly than in Ure's description of Richard Roberts' automatic cast-iron power loom (also referenced by Edward Baines):

> Thus, the *Iron Man*, as the operatives fitly call it, sprung out of the hands of our modern Prometheus at the bidding of Minerva…and even long before it left its cradle, so to speak, it strangled the Hydra of misrule. It is to be hoped that the manufacturers who received this guardian power from mechanical science, will strengthen with grateful patronage the arm which brought them deliverance in the day of their distress.[12]

This passage bears out many of the themes found elsewhere in *The Philosophy of Manufactures*, among them the mythologizing of machines and, by extension, their inventors. Here, as in Cooke Taylor's work, the Roberts loom is born of Minerva's divine wisdom and given to humanity as Promethean fire. It is a gift to enlighten, alleviate, and, more importantly, bring order. Most significantly, this "guardian power" comes not only to relieve the workers of their burdens, but to slay the "Hydra" of labor unrest. Like other passages in Ure's work, these rhetorical flourishes had material motives. Factories

represented large investments on the part of their owners, and equally large losses if they became unprofitable through strikes, machine-breaking, or government regulations. For employers, machines like the Roberts loom, which made workers almost redundant and thus left them with no influence in the workplace, would indeed have represented deliverance from potential ruin.

Like his contemporary Edward Baines and much of the manufacturing class, Ure celebrated mechanical power because it allowed for this reduction of the workers' role in the manufacturing process. What differentiates Ure from Baines is the extent of both Ure's views and his mythological language. He believed that such automatic machines would put an end to unionism, which he saw as a source of conflict detrimental to both workers and employers, and restore manufacturers' complete authority.[13] In his mind, the perfect form of manufacturing was that which involved a minimum of human participation and no manual labor at all.[14] Until this future arrived, the Roberts loom and its counterparts would quell the "distress" of labor organizing and troubled debates on factory reform. Through their scientific perfection and instructive power, machines would bring not only order but salvation to the world of industry. Such was Ure's utopia, a fantastical society that would privilege his own class of academics, educated in mechanics and factory organization.[15]

The Philosophy of Manufactures' glorification of machines was controversial even in the 1800s. Reformers and socialists like Karl Marx and Friedrich Engels critiqued it in their own works on the factory system. Engels denounced Ure's idea that workers should become like machines, calling him a tool of the bourgeoisie, while Marx found Ure's depiction of the steam engine more dictatorial than gracious.[16] However, Ure was not alone in his thinking: the members of the Watt memorial committee, discussed at the beginning

of this chapter, shared his views. The committee members published their proceedings almost a decade prior to *The Philosophy of Manufactures*, but their treatment of machine power carries much the same tone as Ure's. Like many of their contemporaries, they cast steam-powered machinery as an agent of British imperialism, instilling a civilized industriousness in the British working classes and filling foreign onlookers with awe. One participant noted that steamships would soon sail the rivers of South America, bringing the indigenous peoples "to a sort of stupid amazement" at the sight of a vessel moving "without any visible impulse from nature or from human labour."[17]

Like Ure, the committee members found mechanical power thrilling, and like him, they did not revere power for power's sake. They found machinery almost omnipotent, unimaginably stronger than humans and useful for any conceivable task. With steam, machines could "cleave rocks and pour forth rivers from the earth," but notably, this alone did not win the committee's wonderment.[18] What they found most marvelous is that machines were simultaneously as sensitive as they were powerful, a perfect balance of might and restraint. More than once, they noted that these devices were quite capable of turning their great power to delicate operations. "The same giant arms twist the cable-rope, the protector of the largest ship of the line, and spin the gossamer-like threads which are to ornament female beauty," they wrote.[19] The same arms that pumped water from below the earth could construct the head of a pin. Most strikingly, the participants observed with a palpable sense of awe that this power could be "commanded by an infant, whose single hand governs the grandest operations…."[20] Ure also evoked this poignant image of a young worker superintending one of the world's great forces, the machine bowing before the child. This is indeed wondrous in theory, but the reality was often less lofty. Neither Ure

nor the committee paid much heed to the accidents common in early textile factories, nor the effects of repetitive motions and unrelenting concentration.

Unlike Ure, the committee did not envision machines as generous monarchs willingly lending their might to their subjects. Instead, they distinguished the wild, undisciplined excesses of steam from the well-ordered machinery that restrained it. Only through machinery could the power of steam be "lulled into the most complete and secure repose, at the will of man, and under the guidance of his feeble hand."[21] When human ingenuity brought these forces of order and chaos into balance, the result was perfect mechanical power. Hence, the committee revered James Watt himself, the tamer of mechanical power, as much as his contributions to engineering. It was he who "subdued and regulated the most terrific power in the universe" and brought this mighty force "into a state of such perfect organization and discipline, that it may now be safely maneuvered and brought into irresistible action – irresistible, but still regulated, measured, and ascertained."[22] Thus, the committee did not praise mechanical strength alone, but also its orderly, directed nature, the result of a communion between human genius and natural forces. Secondarily, the committee members had economic motives for their attraction to power: they attributed to James Watt the prosperity of manufacturing and the prestige it brought the British Empire.[23]

5.2 Ungentle Giants: Challenges to the Celebration of Mechanical Power

Andrew Ure and the committee members both portrayed mechanical power as a living force with a noble purpose. Critics also perceived this seemingly organic strength, but they did not find it benevolent. In *Sir Thomas More, or, Colloquies on the Progress and Prospects of Society* (1829), the Romantic poet Robert Southey refuted this ideal using

language that might have come from Ure had Southey's work not appeared six years earlier. Southey was dismayed by working conditions in factories, a topic he discussed in with vehemence *Colloquies*. This book consists of a series of dialogues between the narrator Montesinos (a stand-in for Southey) and the ghost of the Renaissance humanist and martyr Thomas More. Their conversations encompass multiple social issues, including poverty, taxation, revolution, and the rights of British Catholics, but Montesinos reserves his bitterest critiques for the factory system. He describes mechanized manufacturing as a cancerous tumor, calling it "a wen, a fungous excrescence from the body politic" which might have been removed or at least restricted had countermeasures been taken quickly. Unfortunately, the growth's "…nerves are branched so widely, and the vessels of the tumor are so inosculated into some of the principal veins and arteries of the natural system, that to remove it by absorption is impossible and excision would be fatal."[24]

This passage vividly depicts two living things at odds with one another: the factory system, here represented as a tumor; and society, portrayed as the afflicted human body. This constitutes a striking inversion of Ure, who described the machines comprising the factory system as the veins, arteries, and nerves of a healthy body. Both authors perceived parallels between organic life and the nineteenth-century factory, but their applications could not be more different. Ure saw the factory as a well-organized body; for Southey that body was instead the pre-mechanical social order, and the factory system a corruption of its cells. The factory system was a living power for Southey just as it was for Ure, but not the highly functional, stabilizing force Ure portrayed. While it had nerves of its own, these would not energize society but rather transform it until it became unrecognizable – colonized by machines, shaped to the purposes of mechanization and those who profited

from it. This use of organic language is jarring in comparison not only to Ure's work, but also Erasmus Darwin's. Not all the forces of nature are as benevolent as Darwin's water nymphs and air spirits. Cancer is also a powerful biological phenomenon, but a malignant one. To Southey, the factory system was the same, and it was a power grown too dominant to resist.

Other reformers also perceived that humans had subordinated themselves to machines in their attraction to power. When these critics wrote of mechanical strength, their figures of speech depicted such strength as dangerous rather than alluring. As discussed in the previous chapter, the physician Peter Gaskell published his own study of the factory system, *Artisans and Machinery* (1836), one year after Ure and Baines wrote their factory treatises. The book was partly a response to these authors, as Gaskell cited from both throughout his work. Like other reformers, Gaskell associated the factory system with multiple social ills, and more importantly for this analysis, he argued this point by critiquing industrial advocates' characterizations of machines. Although in doing so he sometimes romanticized the "golden times" of hand labor, when machines were firmly under human control, his refutation of the kindly steam-powered despot so revered by proponents of industry is no less notable for this flaw.[25]

Like James Kay-Shuttleworth, Gaskell adopted the language of the colossus in his characterization of mechanical power, and like him, Gaskell did not see a titan destined to relieve humanity of onerous burdens. Rather, machines were monsters poised to overwhelm and supplant human workers. Artisans and handworkers were "crushed by their mighty opponent to the dust" and replaced by "another and more subservient" power, "reduced to mere watchers, and mere suppliers of the wants of machinery."[26] Interestingly,

Gaskell here characterized the irresistible machine as "subservient," much as Baines, Knight, and many other industrial advocates did. However, Gaskell used the term differently. "Subservient" in this context does not imply that machines were subordinate to the human will, but rather that, unlike human laborers, machines did not unionize, did not strike, and did not demand better wages and working conditions. They had no awareness of their own condition, or if they did, they did not complain. They simply did what they were given to do. Their power served the manufacturers, not the workers.

Gaskell made this distinction plain later in *Artisans and Machinery*, when he criticized the violent methods used by some unionists and labor activists. He claimed that such tactics only hardened employers against their workers. When pressed, employers would "exert every device…to annihilate the influence of the men beyond simple and subordinate agents to their tractable and gigantic servant the steam-engine," and thus put down union agitation.[27] Here the relationship Gaskell perceived between employee and employer, worker and machine, becomes clear: the machine served the master, and the workers served the machine. Thus, Gaskell rejected the characterization of machines as compassionate entities willing to take on workers' burdens for the sake of workers' physical and mental liberation. His own portrayal carries no hints of compassion at all, nor any real semblance of life, only unthinking servitude to the industrialist. This was the very aspect of mechanization Ure found so desirable, though where Ure saw mechanical power as deliverance – ostensibly for workers but primarily for employers – Gaskell saw it as elimination.

The last chapter of *Artisans and Machinery* contains some of Gaskell's most pointed critiques of Baines, Ure, and Darwin. He quoted at length from Ure's florid

depiction of the "benignant" monarch Steam, cited in part above, taking particular issue with Ure's subsequent attribution of "gentle docility" [28] to steam power. Gaskell remarked in a sharply-worded footnote, "Like other potent genii, steam occasionally puts off its gentle docility, blowing up factories, steam-boats, &c. &c. We presume the author whom we are quoting is ignorant of this."[29] Ure, who lectured in chemistry and physics at the University of Glasgow, would certainly have known that steam could cause explosions, but it is unsurprising that he omitted this fact from his writing: it does not suit his idealistic machine persona. Whatever the case, Gaskell was correct: steam pressure explosions were industrial hazards, although once pressure regulation was automated, accidents decreased.[30] In noting this threat, he refuted the characterization of machines that the Watt memorial committee found so wondrous: immensely powerful but restrained. Gaskell was suspicious of such power. He branded steam a "genii," with the attendant implication that it could not be coaxed back into the lamp and might not always obey those who released it. This adds elements of unpredictability and danger to Gaskell's earlier characterization of machines as tireless hundred-handed giants risen from the pages of Greek mythology.

Gaskell found additional flaws in *The Philosophy of Manufactures*. Ure's descriptions of the healthful, spacious factories that housed machines compelled Gaskell to a forceful commentary on the conditions of working-class life. He was particularly concerned for adult male artisans replaced by unskilled, low-paid women and children:

> …according to Dr. Ure, Mr. Baines…and others, the very perfection of manufacture has been attained. A vast series of automatic machines will be seen revolving in palaces, pouring out produce in endless profusion; but the question deserves being asked – Where is the adult labourer? Even now we find him toiling in damp, unwholesome cellars, perishing of want….[31]

This passage functions primarily as an indictment of unregulated mechanization and automation, which offered little or no protection for displaced workers. In a subtler way, it

also underscores Gaskell's rejection of the glorified machine. He observed that machines were treated better than the human beings who operated them: they had (at least in well-run factories) large, clean workshops in which to reside, indeed, "palaces." Perhaps intentionally, Gaskell's use of this word, with its connotations of royalty, aligns with Ure's portrayal of the machine as a monarch, though the two depictions carry very different implications. Machines were revered, given royal residences if not quite altars, while human workers were consigned to long, monotonous hours and "damp, unwholesome cellars." In economic terms, machines represented large investments and larger profits, while workers were numerous and cheaply employed; hence, machines were more valuable to employers than human labor. Gaskell found this a jarring state of affairs. Though he recognized the legitimate scientific and economic contributions of mechanization, as well as the affordability of machine-made goods, he refused to take an idealistic view.[32] He did not romanticize machines or their purportedly liberating power as industrial advocates did, but instead argued that machines were not gentle, they were not sublime, and they did not live and suffer as humans did. Thus, he concluded, they should not be worshipped for their power while human beings were reduced to poverty.

Gaskell saw machine power as displacement, not rescue. He substantiated this view by critiquing several romantic depictions of machines, including a long passage from engineer Alexander Gordon's *A Treatise Upon Elemental Locomotion and Interior Communication* (1834), in which Gordon celebrated the ubiquity of machines by invoking the "Briarean arms of the steam-engine."[33] Gaskell also employed this mythological allusion, as noted earlier, but Gordon took a much more optimistic view of the hundred-handed giant. He offered an admiring litany of all the many goods steam-powered

machines produced: suits and hats for men, wedding attire for women, farming implements, furniture, ribbons, buttons, shoes, stockings, bonnets, even certain kinds of jewelry, all made fashionable and affordable through the intervention of steam.[34] Gaskell noted that while machines did allow inexpensive clothing to reach large segments of the population, advancements in mechanization led to ever-increasing losses of wages and jobs.

While proponents of industry saw machine power as a liberating force, limiting human exertion and providing the necessities of life, Gaskell could not ignore the other side of this characterization. He addressed the consequences that advocates oversimplified or ignored, and the automatic Roberts loom, celebrated by Ure and Baines, especially concerned him. While Ure and Baines portrayed the "Iron Man" as a marvelous imitation of human dexterity and a panacea for labor agitation, Gaskell saw only the destruction of the working classes. He considered this such a grave matter that in writing of the Roberts loom, he utilized no figurative language. He stripped away all ornamentation and warned in bleakly practical terms that with such machines as the Roberts loom, the textile industry would offer little refuge for workers displaced from other trades. Those who did find jobs would become mere attendants of machinery, and their pay would reflect their limited role in the production process.

While Gaskell challenged the attraction to machine power using industrial advocates' own language, other reformers took a more personal approach. Member of Parliament John Fielden's *The Curse of the Factory System* (1836) is a notable example in that, unlike many others who spoke in support of the working class, Fielden spoke from experience. Growing up in the 1790s, he worked in his father's textile mill as a child laborer. This did not make him an enemy of manufacturing – he went on to become an

industrialist himself – but he strove for higher standards and fairer treatment than other employers. His service in Parliament, too, was marked by firm support for Chartism, factory reform, and industrial regulation. Indeed, it was Fielden who helped to pass the Ten Hours Act in 1847, which limited working hours for women and children. The "curse" to which Fielden referred, therefore, was not that the factory system existed, but that it went unregulated for too long and caused widespread exploitation.[35]

Fielden wrote of machines in purely socioeconomic terms, like Gaskell's writing on the Roberts loom. Gaskell gave this device no persona at all but instead allowed quotations from Ure and Baines to demonstrate what he saw as a dangerous idolization of machine power. Similarly, Fielden's only direct use of the common tropes surrounding mechanization was a quote from Kay-Shuttleworth, cited in Chapter IV, which characterized workers as "drudges" of a "mighty material force." Fielden, then, saw the machine as a grinding juggernaut rather than a revolutionizing, revitalizing agent. Its power was not to be worshipped but to be restrained before it did further harm.

Like Gaskell, Fielden also criticized machine romanticization, drawing upon his experience as a child laborer. For instance, he wrote that although mechanized labor was lighter than manual labor, it was still taxing for children, particularly when performed for long hours. He argued that if children were observed playing after work, this did not mean they were not exhausted, only that children were naturally playful.[36] This point functions as a direct critique of all the authors who returned from their factory tours with reports of smiling, playful children, including Cooke Taylor and Ure. Ure characterized factory children as "lively elves" and claimed that because textile machines' operating cycles allowed workers to stand idle at regular intervals, the work was not tiring.[37] More subtly,

Fielden's comments also undermined those who, like the Watt memorial committee, marveled at machines so powerful yet so docile that children could wield them. Fielden affirmed that he never worked more than a ten-hour day as a child, and the work was lighter than it had since become, but he and his companions still found it exhausting. In his experience, machines were not lions lying down with lambs, and their power was not gentle. However much machinery might lighten labor, this made little difference when tasks were monotonous and workdays could be fifteen hours long.[38]

Fielden also addressed the image of the mechanical servant who willingly worked to reduce human exertion. Drawing on testimony from the Sadler Committee, which investigated the treatment of child factory workers, he asserted that such a characterization was rarely realistic. Far from easing workers' burdens, mechanization had only increased them. The high production capacity of machines had encouraged some employers to extend working hours and shorten breaks to maximize output, and both adults and children exhausted themselves trying to match mechanical operating speeds.[39] Fielden went so far as to liken the life of a factory worker to slavery. He claimed that the British government found limiting colonial slaves' working hours less controversial than factory reform of the same aim, blaming in part the government's laissez-faire ethos and firmly asserting that the new machine age necessitated more regulation.[40]

Though industrial advocates as well as some reformers, including Gaskell, believed the Sadler Committee's evidence was exaggerated, Fielden's use of this and other impassioned reports nonetheless created a damning picture of mechanization.[41] He admitted to the need for reform even in his own textile mills. He found that his factory children walked the equivalent of twenty miles in a day even though he did not run his

machinery "at anything like the speed" other employers did.[42] This admission cannot be accepted uncritically, as Fielden himself did not describe how he calculated this distance. Given that *The Curse of the Factory System* was intended to promote the passage of factory regulation, it may be an exaggeration. Nevertheless, with the acknowledgment that even his presumably well-run factories needed improvement, Fielden implied that machines could never be the gentle aids their advocates sought to depict. Even when run with moderation, they remained by their nature so much stronger and more enduring than human workers that they could not help but exhaust their operators. However attractive mechanical power might be, it did not serve humanity when left unchecked. Fielden warned that blind reverence for machines had spread even to America, where Kentucky statesman Henry Clay asked, "Who has not been delighted with the clockwork movements of a large cotton-manufactory?"[43] Clay had reason to be delighted, both with the textile mill's engineering and its economic prospects. However, Fielden urged Parliament to remember that in making England the "workshop of the world," it might also make her "the slaughterhouse of Mammon" if machine power and the industrialists who extolled it were not restrained.[44]

It must be noted that nineteenth-century treatments of mechanization and the factory system are often highly polarized, even propagandistic. *The Philosophy of Manufactures* depicts the best of technological advancement, while *The Curse of the Factory System* highlights the worst abuses and exploitations of the mechanical age. Just as Ure desired complete automation and a place of privilege for intellectuals like himself, Fielden sought the passage of enforceable factory reform. These motives influenced both authors, as they influenced many others on both sides of the mechanization debate. Both also made valid points: machines were powerful symbols of human ingenuity, and child

exploitation was indeed appalling. However, we can see the possibility for a middle ground between these two positions, a moderate view which recognizes the technological wonder of machines as well as their negative socioeconomic effects and the need for regulation.

This view manifests only rarely in nineteenth-century sources. As we have seen, proponents of mechanization tended to acknowledge the consequences of machinery only briefly, if at all. When they did so, they explained such consequences away with simplistic arguments. Likewise, reformers admitted that well-run factories did exist, but they warned that these were the exceptions, not the rule. This polarization may be the result of the dramatic changes brought about by industrialization. Such changes naturally stirred strong emotions, from which came the opposing machine personae of the deliverer and the demon. The crises of child labor and poverty left no room for the reformer to marvel at mechanical power or ingenuity. The lure of utopia all but blinded the industrialist to the effects of rapid social change. We must wonder how a neutral observer might perceive the machine, if such an observer existed.

CHAPTER VI

CASSINI AND MACHINES AS EXPRESSIONS OF WILL

The social and emotional significance of nineteenth-century mechanization precluded genuine objectivity, giving rise to the spectrum of perceptions presented above. To distill this array, we return to Gerald Stanley Lee's *The Voice of the Machines*, first referenced in Chapter III's discussion of machines as organic life. Though Lee wrote in early-twentieth-century America, he eloquently captured the spirit of British industrialization and the profound relationship between humans and machines:

> The engineer who is not expressing his whole soul in his engine…is not worthy to place his hand upon an engine's throttle. Indeed, who is he – this man – that this awful privilege should be allowed to him, that he should dare to touch the motor nerve of her, that her mighty forty-mile-an-hour muscle should be the slaves of the fingers of a man like this…? It is impossible to believe that an engineer – a man who with a single touch sends a thousand tons of steel across the earth as an empty wind can go…does not love to do it because he means something by it.[1]

Unlike similarly rapturous quotations from Edward Baines and Andrew Ure, this passage contains no undercurrents of nationalism or greed, no scarcely concealed advocacy for the elimination of human labor. It expresses no more or less than a sincere admiration for machines and the people who operate them. Lee honored the figure of the engineer simultaneously humbled and emboldened by bending a force so much stronger than himself to his will, and he perceived the operation of machinery as a kind of prayer, an expression

of the operator's innermost thoughts and feelings and dreams. It must be noted that this passage concerns steam locomotives, which lack the popular associations with labor exploitation that factory machines acquired over the course of the nineteenth century. The image of railways, rightly or wrongly, is largely a romantic one. However, Lee's philosophy applies just as aptly to factory machines. Indeed, nineteenth-century authors expressed much the same sentiments when they wrote of God-given inventive impulses and marveled at steam engines so strong yet apparently so tame that children could run them. Rosy though these images are, these writers along with Lee nevertheless recognized machines as the embodiments not only of human ingenuity, but of something even more intangible. Lee poignantly encapsulated this intangibility in recounting a conversation in a steamship's engine room. Amidst that "mighty heart-beat [the engineer] stood with his strange, happy, helpless 'Twelve thousand horse-power, sir!' upon his lips."[2] For this crewman, the steam engine is quite literally beyond description: left with no other words, he resorts to a specification of mechanical power. Lee's account gives the impression, however, that this does not capture the privilege and unadulterated wonder the crewman finds in operating such a mighty device.

Like all the authors presented here, Lee was biased: machines plainly fascinated him both intellectually and spiritually. However, his perspective does divest machines of all their tangled socioeconomic implications, leaving behind a core persona as simple as it is profound: the machine as a channel for the human will in all its aspects. For nineteenth-century industrialists and their allies, machines manifested what they saw as positive aspects of that will: the drive for advancement, the love of making clever things, and the amassing of power. For reformers, machines instead symbolized the overwhelming desire

for profit, the callous exploitation of fellow human beings, and the reckless push for change. The meaning of machines changed with the observer: progress, creativity, strength, precision, greed, ruthlessness, degradation. They were tools, taskmasters, destroyers and slavedrivers, means of enrichment, new forms of life, and objects of worship. To reduce them to any one of these personae is to overlook their full and vivid imaginative life.

Human beings still marvel at the power of technology as Lee's steamship engineer did, and they continue to find life within it. For many citizens of the twenty-first century as much as for Lee, machines exemplify the human spirit of progress, exploration, and conquering obstacles. The public response to the retirement of the *Cassini* space probe in September 2017 provides a stirring contemporary example. Launched by NASA in 1997, *Cassini*'s mission spanned nearly twenty years. It spent thirteen of these years studying Saturn's rings, atmosphere, and satellites, particularly the environments of some of its moons. After two decades in service, the probe's fuel reserves were depleted. To avoid contaminating Saturn's moons, *Cassini* took a controlled dive into that planet's atmosphere, transmitting data to Earth until the moment the probe burned up as meteors do. This event was popularly known as the Grand Finale, and the many subsequent tributes to *Cassini* demonstrate that the nineteenth-century propensity to personify machinery has not faded. In an article for *The Guardian*, Andrew P. Street recalled his realization that by the time *Cassini*'s final transmissions reached Earth, they would be coming from "the ghost of a robot that hadn't existed for more than an hour."[3] In addition to this implication, however figurative it may be, that *Cassini* had a soul, the article's title poignantly sums up Street's anthropomorphic view of the probe: "Tracing Cassini's fiery death was like seeing a heart monitor flatline."[4]

Street was not alone in his views. *Cassini* project scientist Linda Spilker endowed the machine with a definite and richly human personality at a NASA press conference in April 2017: "Of course it's really going to be hard to say goodbye to this plucky, capable little spacecraft that has returned all this great science."[5] This suggests that much like Charles Dickens's locomotive engineers, the *Cassini* operators knew the probe's eccentricities and looked upon it as a friend and partner. Hearkening back to another trend of nineteenth-century industrial writing – mythologizing the machine – Alan Burdick of *The New Yorker* compared and contrasted *Cassini*'s end with the fall of Icarus. He stated that "[p]erhaps, in *Cassini*, we have built [Icarus's] better twin. Twenty years wiser, it plummets for the benefit of the cosmos, toward a place that human design and, perhaps, nature will prevent it from ever reaching."[6] Finally, a newsletter from the Department of Climate and Space Sciences and Engineering at the University of Michigan, which summarizes the end of *Cassini*'s mission, closes with the statement, "*Thank you, Cassini.*"[7] Though this closing line necessarily implies an additional debt of gratitude to *Cassini*'s builders and operators, the probe itself is the primary addressee. It cannot receive any thanks, but the authors of the newsletter plainly felt compelled to express their appreciation directly to this machine that served science for almost twenty years. These articles and others like them suggest that both scientists and lay people alike felt affection for *Cassini*. For them, its retirement was not the mere destruction of a piece of technology, but a difficult personal loss.

Much as their predecessors did for steam engines and textile machines, the contemporary public gave *Cassini* a vivid life of its own: as the mythical "better twin" of Icarus, as a partner in science, as a "plucky" space explorer. While the tributes to *Cassini*

did not constitute the machine funerals Samuel Butler's anti-machinist foresaw in *Erewhon*, they could indeed be called memorials. That the characterizations employed by those familiar with *Cassini* closely parallel the machine personae of the 1800s is also significant. Today, machines still convey a semblance of life – with the rise of artificial intelligence, they have become more lifelike than ever – and share working relationships with human beings much as they did in the nineteenth century, if not more so. *Cassini* provides a particularly dramatic example, but on a more mundane note, many people are as fond of their cars as Dickens's engineers were of their locomotives.

The case of *Cassini*, when considered alongside Lee's commentary on machines as expressions of human will, helps to explain why machines so captivated the nineteenth-century imagination. *Cassini* was a deeply human construct. In a physical sense, it was the product of human intelligence; in a metaphorical sense, it symbolized the desire to explore as far as possible and uncover the workings of the universe. The probe bore no resemblance to human life either in its appearance or its behavior, but it attracted anthropomorphic language nonetheless because it embodied the humanity – the ambitions, curiosity, and inventiveness – of its creators. The same held true for nineteenth-century machines: they, like *Cassini*, were human constructs, given life by both their engineers and the public imagination, the embodiments of abstract qualities and motivations. Workers and employers, of course, projected very different experiences onto the machines they used: the desperate need for wages versus the desire for profit or the genuine belief that automation constituted deliverance rather than elimination. In either case, machines were and are a means of survival at the least, and often a way of attaining convenience and achieving one's goals as well. They are vessels for thoughts and motives, and although

they present different (and often conflicting) faces to different people, all these faces exist simultaneously.

Not all machines elicit such figurative language, in the nineteenth century or today. Victorian authors did not exalt the spinning wheel as they did the steam engine, nor do modern Americans mourn their old household appliances as they mourned *Cassini*. Nineteenth-century sources indicate that a machine must meet certain qualifications before it attracts metaphors and human language. Some such devices bore superficially noticeable parallels to organic life: Andrew Ure's comparison between the shafts and gears of a factory and the nerves and arteries of a body, for example, is relatively apparent. However, Dorothy Wordsworth also saw life in a steam-powered water pump employed at a mine. At the time of her 1803 visit to Scotland, this device would have been comparatively simple in design when measured against later industrial machinery. Its most visible and recognizable component would likely have been a large rocking beam mounted on the wall of the engine house, with the piston and the rod that drove the pump in the mine shaft hung from opposite ends of the beam. There is nothing particularly anthropomorphic about this design, and yet Wordsworth perceived not only an exertion of effort in the beam's slow back-and-forth motion, but also a sense of breathing and even rudimentary intellect. She noted that the engine signaled its transformation from insentient wood and metal to primitive life by its display of power. Although the pumping engine Wordsworth saw at the Scottish mine was an early machine, slower and less efficient than its descendants, it nevertheless far surpassed the limits of human strength. More importantly, it operated autonomously. Once the boiler was fired and the engine started, it ran of its own accord, employing principles of gravity and atmospheric pressure, for as long as it had fuel. The

same could be said of factory machines, particularly once speed adjustments and steam pressure regulation became automatic.

This, then, is the requirement: for a machine to attract figurative language, for it to properly reflect the will of its operators and creators, it must seem to be alive. It must be an active entity, capable of working not just with but *for* its human operators. It is significant that the steam engine governor fascinated several of the authors discussed here, including Babbage, Butler, and the James Watt memorial committee. This device was indeed an ingenious piece of engineering, but more so, it allowed steam engines to regulate their own speeds. Not for nothing did Ure speak of factory machines as self-acting androids – they did not look human, but they performed human tasks. A manual tool is useless without a wielder, and thus it does not appear to have any capacity for will. Steam-powered machines did appear to have this capacity, whether it was the embodied will of their inventors, owners, or operators or, in Butler's case, a will of their own. *Cassini* demonstrates this as well: like Babbage's calculating engines, it operated on pre-programmed directives, giving it the semblance – though not the reality – of autonomy.[8] It is thus their perceived agency and self-willed use of power that makes machines appear not only lifelike, but human-like. It is for this reason that nineteenth-century authors perceived machines as reshaping society as much as owners, operators, and inventors if not more so, for the mystique and apparent influence of machines often eclipsed the humans standing beside them.

CHAPTER VII

CONCLUDING REMARKS

This analysis has explored several different characterizations of machines, from the material to the spiritual. Some authors used such figurative language to make mechanization less intimidating or to promote automation, some to advocate more urgently for reform, some to praise human creativity and progress. Any entity laden with such hopes and emotions and dramatic social influence will understandably acquire a figurative life, and machines appeared to be as actively involved in reshaping nineteenth-century society as any human. They were an integral part of the economic system and the focal point for a range of responses to social change. The same logic applies to both positive and critical depictions of industrialization: reformers linked mechanization to feelings as strong as those of advocates and criticized machines as much as they criticized manufacturers, if not more so. Even the famous Luddite machine-breakers and their counterparts in agricultural labor did not often extend their violence to industrialists and farm owners, suggesting that they located the source of their hardships in machines themselves rather than in their employers.[1] In their eyes, machines were the primary symbols of oppression, and capitalists only secondarily so.

A close reading of the figurative language surrounding mechanization also helps explain why nineteenth-century industrial regulation came so slowly and met with such resistance. To be sure, many factory owners, motivated by profit, were unwilling to accept the expenses of implementing safety reforms, shortening hours, and raising working ages. Others believed that mechanization would ultimately benefit both workers and employers after a difficult transitional period. Examining machine characterizations reveals an additional factor for consideration. The broad range of authors – specialists and lay people, advocates and critics – who drew from the same pool of metaphors indicates that machines thoroughly captivated society at large. Authors referred almost universally to this new technology's great power or even omnipotence. Whether they feared or revered it, they recognized that this power was dramatically altering their world and they stood in awe of it. Given this, it is plausible that many observers did not initially know how machines might be restrained, or indeed if they could be restrained at all. Others did not think restraint necessary. While they debated this question, people on both sides of the argument used figurative language to help navigate the shift to a new industrial order and the growing presence of machines in their lives. Giving mechanization the name and the face of a familiar object, be it a tool, a mythical creature or god, a biblical figure, or an organic body, allowed writers to better express the feelings they associated with machines. Only once the initial shock had passed, only once this mass fear and awe was expressed, could the mundane but necessary work of reform begin.

The sources also suggest that the closer one's proximity to machines, the more difficult it was to perceive them objectively. Of the authors presented here, it is notably the members of the scientific community – people associated with rationality – who spoke the

most romantically of mechanical power. Some of these people, such as the physicians James Kay-Shuttleworth and Peter Gaskell, did employ their training to assess working conditions and advocate for the laboring population. The engineers, inventors, and professors, however, took a distinctly more idealistic view, perhaps precisely because they knew machines so well. Their knowledge of machines' inner workings made such devices even more attractive to them: they were the best equipped to appreciate machines' "beautiful combinations," to employ Charles Babbage's phrase. They could admire mechanical strength from a position not of distant wonder but of intimate understanding. However, although they comprehended machines' technical aspects better than any of their contemporaries, they were not of the factory population, and they did not perform mechanized labor. They could not fully appreciate the experience of the parliamentarian John Fielden, who shared an equally intimate but far less positive relationship with machines as a child laborer in his father's mill. Thus, they struggled to recognize the counterpoint to the genius and unlimited benefits that machines embodied for them.

Examining machine characterizations and possible motives for using them also underscores the close bonds between machines and humanity. The machine of the nineteenth century is inextricable from well-explored issues of class, gender, politics, social identity, and human beings' relationship to their work. It is also a rich, complex entity given life by the public imagination and interwoven with a range of experiences and perceptions of the world. Greed and its accompanying labor exploitation, which have not unreasonably become the most common images of the Industrial Revolution, constitute only one aspect of this experience. Machines embody both the positive and the negative aspects of industrialization, from the struggle for workers' rights to the increased

availability of necessary goods to the transformative relationship between human beings and their mechanical partners. Machines' ability to permeate everyday culture and fascinate the public persists today, at times in new forms and at other times in forms very similar to those of centuries ago. Some modern idioms analogizing mechanical and human behavior, such as "blow off steam" and "run out of steam," undoubtedly originated with the boilers and engines of the Industrial Revolution.

Although machines remain evocative and complex symbols even today, they are no longer unrestrained. As stated in the introduction, many of the sources presented here were published in the 1830s and 1840s because this was a period of debate on factory reforms, and this was also the beginning of the end for unregulated manufacturing. Enforceable reform came slowly, but from this time onward the consequences of mechanization would be clearly exposed, labor laws would be enacted, and machines would be fenced in – both literally and figuratively. They would maintain power, but not omnipotence or the accompanying thrill. They could no longer be run as long as possible or as fast as possible or by children too young to be at work. Although they never quite lost their imaginative appeal, exuberance diminished as legislation reduced machines to something that more closely resembled the tools Charles Knight set forth in 1831. The many Factory Acts did not eliminate poverty or labor exploitation, but they did establish a code of conduct. If the machine remained Briareus by virtue of its great strength and dexterity, it was Briareus leashed.

The lessons of the nineteenth century remain relevant today as automation accelerates. Machines continue to become more capable than ever, and human workers continue to suffer much the same displacement as the artisans of the 1800s. It is as

important now as it was then to consider the relationship between humans and machines and the ways in which we shape this relationship with our language and imaginative conceptions. It is also as important as ever to understand the incredible variability of the machine as a symbol. Its significance changes with the observer: where one sees an instrument of deliverance, another sees an insidious thief of livelihood, and both perceptions are valid. As Fielden suggested in 1836, the curse of machines is not that they exist, nor that they are objects of wonder and pride. The technological achievements of the late eighteenth and nineteenth centuries, like those of the twenty-first, are indeed worthy of celebration. Excessive celebration, however – excessive wonder and pride – sometimes leads to greed and neglect. Though their form has changed and undoubtedly will change again, machines are unlikely to fade away, as is their imaginative stimulus, and thus, machine personae will also endure.

Though *Cassini* provides one example of the parallels between contemporary and nineteenth-century conceptions of machines, it is only one case study. Further research would allow for richer comparisons. Nineteenth-century workers' perspectives are also scarce, as reformers often spoke on their behalf, though they are necessary to the task of forming a complete picture of machine characterizations then and now. One thing seems certain, however, and Dorothy Wordsworth stated it most succinctly in her depiction of the Scottish mine's pumping engine: if machines use their power with apparent autonomy, the perception of life follows. The temptation to endow machines with life has persisted through the centuries, a life as active as that of the humans who work alongside them.

NOTES

I. Introduction

[1] Dorothy Wordsworth, *Recollections of a Tour Made in Scotland, A.D. 1803*, ed. John Campbell Shairp (Edinburgh: Edmonston and Douglas, 1874), 17, https://catalog.hathitrust.org/Record/009185948.

[2] Wordsworth, *Recollections*, 17.

[3] Ibid.

[4] Joseph Bizup, *Manufacturing Culture: Vindications of Early Victorian Industry* (Charlottesville: University of Virginia Press, 2003), 14.

[5] Herbert Sussman, *Victorian Technology: Invention, Innovation, and the Rise of the Machine* (Santa Barbara: ABC-CLIO, 2009), 61-62.

[6] Tamara Ketabgian, *The Lives of Machines: The Industrial Imaginary in Victorian Literature and Culture* (Ann Arbor: University of Michigan Press, 2011), 163.

II. Euphemizing Mechanization

[1] "The article on machine-breaking, in answer to Swing," (London: Robert Heward, 1831), 2, https://www.jstor.org/stable/60213745.

[2] "The article on machine-breaking," 6.

[3] Ibid., 3.

[4] Charles Knight, *The Results of Machinery: namely, cheap production and increased employment exhibited: being an address to the working-men of the United Kingdom*, American ed. (Philadelphia: Carey & Hart, 1831), 162, https://catalog.hathitrust.org/Record/008596143/Home.

[5] Knight, *The Results of Machinery*, 191.

[6] Ibid., 25-26.

[7] Ibid., 68.

[8] Ibid., 29.

[9] Ibid., 30.

[10] Ibid., 10-11.

[11] Knight, *The Results of Machinery*, 193.

[12] Charles Knight and the Society for the Diffusion of Useful Knowledge, *An address to the labourers, on the subject of destroying machinery* (London: Charles Knight, 1830), 2, https://www.jstor.org/stable/60248962.

[13] Knight, *An address to the labourers*, 3.

[14] Ibid., 8.

[15] F., "What is a Machine?" *The Dublin Penny Journal* 1, no. 32 (February 2, 1833): 255, https://www.jstor.org/stable/30002852.

[16] F., "What is a Machine?" 255.

[17] Ibid.

[18] Ibid.

[19] F., "The Rise and Progress of Cotton Spinning," *The Dublin Penny Journal*, 1, no. 29 (January 12, 1833): 230, https://www.jstor.org/stable/30003112.

[20] F., "Cotton Spinning," 230.

[21] Ibid.

III. The Organic Machine

[1] Frances Ann Kemble, *Record of a Girlhood*, vol. 1 (London: R. Bentley and Son, 1878), 197, https://catalog.hathitrust.org/Record/001362908.

[2] Kemble, *Record of a Girlhood* 1:197.

[3] William Wordsworth, "The Parsonage," in *The Excursion*: *being a portion of The recluse, a poem by William Wordsworth*, 2nd ed. (London: Longman, Hurst, Rees, Orme, and Brown, 1820), 366, https://catalog.hathitrust.org/Record/001428253.

[4] William Wordsworth, "The Parsonage," 368.

[5] Ibid.

[6] Erasmus Darwin, "The Loves of the Plants," in *The Botanic Garden: A Poem in Two Parts* (London: J. Johnson, 1791), 61-62, https://catalog.hathitrust.org/Record/100025379.

[7] Erasmus Darwin, "The Economy of Vegetation," in *The Botanic Garden: A Poem in Two Parts* (London: J. Johnson, 1791), 26-27, https://catalog.hathitrust.org/Record/100025379.

[8] Siobhan Carroll, "On Erasmus Darwin's *The Botanic Garden*, 1791-1792," *BRANCH: Britain, Representation, and Nineteenth-Century History*. Ed. Dino Franco Felluga. Extension of *Romanticism and Victorianism on the Net*, https://www.branchcollective.org/?ps_articles=siobhan-carroll-on-erasmus-darwins-the-botanic-garden-1791-1792.

[9] Darwin, "The Economy of Vegetation," 26-27.

[10] Frances Ann Kemble, *Record of a Girlhood*, vol. 2 (London: R. Bentley and Son, 1878), 161, https://catalog.hathitrust.org/Record/001362908.

[11] Kemble, *Record of a Girlhood*, 2:161.

[12] Tamara Ketabgian, *The Lives of Machines: The Industrial Imaginary in Victorian Literature and Culture* (Ann Arbor: University of Michigan Press, 2007), 163. Charles Dickens, "Chips: The Individuality of Locomotives," *Household Words* 1, no. 26 (21 September 1850), 614, http://www.djo.org.uk.

[13] Dickens, "The Individuality of Locomotives," 614.

[14] Ibid.

[15] Ketabgian, *The Lives of Machines*, 163.

[16] Gerald Stanley Lee, *The Voice of the Machines: An Introduction to the Twentieth Century* (New York: Doubleday, 1906), 28, https://catalog.hathitrust.org/Record/100570739.

[17] Alexander Somerville, *The Autobiography of a Working Man* (London: Charles Gilpin, 1848), 360, https://catalog.hathitrust.org/Record/001350912.

[18] Somerville, *Autobiography*, 360.

[19] HL Deb. 27th February 1812, 1, col. 967. https://api.parliament.uk/historic-hansard/lords/1812/feb/27/frame-work-bill.

[20] Samuel Butler, *Erewhon*, New and Revised Edition (London: Grant Richards, 1901), 233, 237, https://catalog.hathitrust.org/Record/010943109.

[21] Butler, *Erewhon*, 237.

[22] Butler, *Erewhon*, 248.

[23] Ibid.

[24] Butler, *Erewhon*, 266-67.

[25] Ibid., 255.

[26] Ibid., 254.

[27] Ibid., 266.

[28] Ibid., 246.

[29] Ibid.

[30] Butler, *Erewhon*, 267-68.

[31] Ibid., 268.

[32] Ibid., 270.

[33] Ibid.

IV. Mechanical Order Sparks Machine Veneration

[1] F., "The Rise and Progress of Cotton Spinning," 230.

[2] *A Guide to the Great Exhibition: containing a description of every principal object of interest: with a plan, pointing out the easiest and most systematic way of examining the contents of the Crystal Palace* (London: George Routledge and Co., 1851), 107, https://catalog.hathitrust.org/Record/100236097.

[3] *A Guide to the Great Exhibition*, 107-108.

[4] Sussman, *Victorian Technology*, 61-62.

[5] William Cooke Taylor, *Notes of a tour in the manufacturing districts of Lancashire; in a series of letters to His Grace the Archbishop of Dublin* (London: Duncan and Malcolm, 1842), vi, https://catalog.hathitrust.org/Record/009737184.

[6] Cooke Taylor, *Notes of a Tour,* 5.

[7] Ibid., 4.

[8] Eric Hobsbawm, *Industry and Empire: From 1750 to the Present Day*, 2nd ed. (New York: The New Press, 1999), 38.

[9] Cooke Taylor, *Notes of a tour*, 17.

[10] Ibid., 5.

[11] Ibid., 54.

[12] Cooke Taylor, *Notes of a tour*, 110-111. *Lexico: Powered by Oxford*, "Definition of tenter," accessed March 14, 2021, www.lexico.com/definition/tenter.

[13] Cooke Taylor, *Notes of a tour*, 121.

[14] Ibid., 120.

[15] Ibid., 243-244.

[16] Ibid., 140.

[17] Ibid., 164-165.

[18] Edward Baines, *History of the Cotton Manufacture in Great Britain* (London: H. Fisher, R. Fisher, and P. Jackson, 1835), 64, https://catalog.hathitrust.org/Record/001045735.

[19] Baines, *History of the Cotton Manufacture*, 186.

[20] Ibid., 243.

[21] Ibid., 460.

[22] Ibid., 212.

[23] Ibid.

[24] Charles Babbage, *On the Economy of Machinery and Manufactures* (London: Charles Knight, 1835), 27, https://catalog.hathitrust.org/Record/002373644.

[25] Babbage, *Economy of Machinery*, 265.

[26] Ibid., 49.

[27] Ibid., 49-50.

[28] Sussman, *Victorian Technology*, 43.

[29] Ibid., 46.

[30] Charles Babbage, *The Ninth Bridgewater Treatise: A Fragment*, 2nd ed. (London: John Murray, 1838), 34-38, https://catalog.hathitrust.org/Record/001391815.

[31] Babbage, *Ninth Bridgewater Treatise*, 40.

[32] Ibid., 45.

[33] Ibid., 96-97.

[34] Tamara Ketabgian, "Prosthetic Divinity: Babbage's Engine, Spiritual Intelligence, and the Senses," *Victorian Review* 35. no. 2 (Fall 2009), 33. http://www.jstor.com/stable/41038833.

[35] Babbage, *Ninth Bridgewater Treatise*, 33.

[36] "Hand Loom Weavers and Factory Workers" (London: C. & W. Reynell, 1835), 2, https://www.jstor.org/stable/60203199.

[37] "Hand Loom Weavers and Factory Workers," 2.

[38] Ibid.

[39] Cooke Taylor, *Notes of a tour*, 302.

[40] E.P. Thompson, *The Making of the English Working Class* (New York: Random House, 1963), 357-358.

[41] James Kay-Shuttleworth, *The Moral and Physical Condition of the Working Classes Employed in the Cotton Manufacture in Manchester* (London: J. Ridgway, 1832), 10, https://catalog.hathitrust.org/Record/011924801.

[42] Kay-Shuttleworth, *Moral and Physical Condition*, 39.

[43] Ibid., 72.

[44] Ibid., 19-21.

[45] Ibid., 42-43.

[46] Ibid., 12, 26-27.

[47] Kay-Shuttleworth, *Moral and Physical Condition*, 55-56.

[48] Peter Gaskell, *Artisans and Machinery: The Moral and Physical Condition of the Manufacturing Population, Considered with Reference to Mechanical Substitutes for Human Labor* (London: J.W. Parker, 1836), 143-144, https://catalog.hathitrust.org/Record/001430047.

[49] Baines, *History of the Cotton Manufacture*, 212.

[50] Gaskell, *Artisans and Machinery*, 150.

[51] Ibid.

[52] Gaskell, *Artisans and Machinery*, 255.

V. The Allure of Mechanical Power

[1] C.H. Turner, *Proceedings of the public meeting held at Freemasons' Hall, on the 18th June, 1824, for erecting a monument to the late James Watt* (London: John Murray, 1824), 10, https://catalog.hathitrust.org/Record/002011672.

[2] Andrew Ure, *The Philosophy of Manufactures; or, An exposition of the scientific, moral, and commercial economy of the factory system of Great Britain*, (London: Charles Knight, 1835), 32, https://catalog.hathitrust.org/Record/001430052.

[3] Ure, *Philosophy of Manufactures*, 32.

[4] Andrew Ure, *A Dictionary of Arts, Manufactures, and Mines: Containing a Clear Exposition of their Principles and Practice* (New York: D. Appleton & Co., 1844), 83, https://catalog.hathitrust.org/Record/008631549.

[5] *Lexico: Powered by Oxford*, "Definition of automaton," accessed March 29, 2021, https://www.lexico.com/definition/automaton. *Lexico: Powered by Oxford*, "Definition of android," accessed March 29, 2021, https://www.lexico.com/definition/android.

[6] Ure, *Philosophy of Manufactures*, 10.

[7] Ibid., 15.

[8] Ibid., 278.

[9] Ibid., 18.

[10] Ibid., 19, 340.

[11] Ibid., 35.

[12] Ure, *Philosophy of Manufactures,* 367-368.

[13] Ibid., 331.

[14] Ibid., 1.

[15] Steve Edwards, "Factory and Fantasy in Andrew Ure," *Journal of Design History* 14, no. 1 (2001): 21, 24, https://www.jstor.org/stable/35272.

[16] Bizup, *Manufacturing Culture*, 23, 206.

[17] Turner, *Proceedings*, 44-45.

[18] Ibid., 56.

[19] Ibid., 11.

[20] Ibid.

[21] Turner, *Proceedings*, 33.

[22] Ibid.

[23] Turner, *Proceedings*, 69-70.

[24] Robert Southey, *Sir Thomas More, or, Colloquies on the Progress and Prospects of Society*, Vol. 1 (London: John Murray, 1829), 171, https://catalog.hathitrust.org/Record/001186040.

[25] Gaskell, *Artisans and Machinery*, 12.

[26] Ibid., 144.

[27] Ibid., 282.

[28] Ure, *The Philosophy of Manufactures,* 18, quoted in Gaskell, *Artisans and Machinery*, 318.

[29] Gaskell, *Artisans and Machinery*, 318.

[30] Sussman, *Victorian Technology*, 12-13.

[31] Gaskell, *Artisans and Machinery*, 332.

[32] Ibid., 321.

[33] Alexander Gordon, *A Treatise upon elemental locomotion, and interior communication, wherein are explained and illustrated, the history, practice, and prospects of steam carriages: and the comparative value of turnpike roads, railways, and canals*, 2nd ed. (London: T. Tegg & Son, 1834), 10-11, quoted in Gaskell, *Artisans and Machinery*, 327.

[34] Gordon, *A treatise upon elemental locomotion*, 326-27.

[35] John Fielden, *The curse of the factory system, or, A short account of the origin of factory cruelties, of the attempts to protect the children by law, of their present sufferings, our duty towards them, injustice of Mr. Thompson's bill, the folly of the political economists, a warning against sending the children of the South into the factories of the North* (London: A. Cobbett, 1836), 34, https://catalog.hathitrust.org/Record/006069333.

[36] Fielden, *The Curse of the Factory System*, 32.

[37] Ure, *The Philosophy of Manufactures*, 301.

[38] Fielden, *The Curse of the Factory System*, 15.

[39] Ibid., 35.

[40] Ibid., 41.

[41] Gaskell, *Artisans and Machinery*, 2.

[42] Fielden, *The Curse of the Factory System*, 40.

[43] Ibid., 72.

[44] Ibid., 74.

VI. *Cassini* and Machines as Expressions of Will

[1] Lee, *The Voice of the Machines*, 28-29.

[2] Ibid., 44-45.

[3] Andrew P. Street, "Tracing Cassini's fiery death was like seeing a heart monitor flatline," *The Guardian*, 15 September 2017, https://www.theguardian.com/science/2017/sep/16/tracing-cassinis-fiery-death-was-like-seeing-a-heart-monitor-flatline.

[4] Street, "Tracing Cassini's fiery death."

[5] Fedor Kossakovski, "Analysis: Why NASA's Cassni probe had to be destroyed," *PBS News Hour*, 13 September 2017, https://www.pbs.org/newshour/science/analysis-nasas-cassini-probe-must-destroyed.

[6] Alan Burdick, "Saying Goodbye to Cassini, the NASA Mission that Transformed Our Understanding of the Solar System," *The New Yorker*, 14 September 2017, https://www.newyorker.com/tech/annals-of-technology/saying-goodbye-to-cassini-the-nasa-mission-that-transformed-our-understanding-of-the-solar-system.

[7] "Historic Cassini Mission Ends with Dramatic Dive into Saturn," *The Daily Planet: Department of Climate and Space Sciences and Engineering Newsletter*, University of Michigan, Fall 2017, http://clasp-research.engin.umich.edu/dailyplanet/2017/fall/cassini-ends.html.

[8] C. Sollazzo, J. Rakiewicz, and R.D. Wills, "Cassini-Huygens: Mission operations," *Control Engineering Practice* 3, no. 11 (Nov. 1995), 1631, https://doi.org/10.1016/0967-0661(95)00174-S.

VII. Concluding Remarks

[1] Eric Hobsbawm and George Rudé, *Captain Swing*, 2014 ed. (New York: Verso Books, 2014), 287.

BIBLIOGRAPHY

Babbage, Charles. *The Ninth Bridgewater Treatise: A Fragment*. 2nd edition. London: John Murray, 1838. https://catalog.hathitrust.org/Record/001391815.

Babbage, Charles. *On the Economy of Machinery and Manufactures*. London: Charles Knight, 1835. https://catalog.hathitrust.org/Record/00237364.

Baines, Edward. *History of the Cotton Manufacture in Great Britain.* London: H. Fisher, R. Fisher, and P. Jackson, 1835. https://catalog.hathitrust.org/Record/001045735.

Bizup, Joseph. *Manufacturing Culture: Vindications of Early Victorian Industry*. Charlottesville: University of Virginia Press, 2003.

Burdick, Alan. "Saying Goodbye to Cassini, the NASA Mission that Transformed Our Understanding of the Solar System." *The New Yorker*, 14 September 2017. https://www.newyorker.com/tech/annals-of-technology/saying-goodbye-to-cassini-the-nasa-mission-that-transformed-our-understanding-of-the-solar-system.

Butler, Samuel. *Erewhon*. New and Revised Edition. London: Grant Richards, 1901. https://catalog.hathitrust.org/Record/010943109.

Carroll, Siobhan. "On Erasmus Darwin's *The Botanic Garden*, 1791-1792," *BRANCH: Britain, Representation, and Nineteenth-Century History*. Edited by Dino Franco Felluga. Extension of *Romanticism and Victorianism on the Net*. https://www.branchcollective.org/?ps_articles=siobhan-carroll-on-erasmus-darwins-the-botanic-garden-1791-1792.

Cooke Taylor, William. *Notes of a tour in the manufacturing districts of Lancashire; in a series of letters to His Grace the Archbishop of Dublin*. London: Duncan and Malcolm, 1842. https://catalog.hathitrust.org/Record/009737184.

Darwin, Erasmus. *The Botanic Garden: A Poem in Two Parts*. London: J. Johnson, 1791. https://catalog.hathitrust.org/Record/100025379.

Dickens, Charles. "Chips: The Individuality of Locomotives." *Household Words* 1, no. 26 (21 September 1850): 614-615. http://www.djo.org.uk.

"Definitions, Meanings, Synonyms, and Grammar by Oxford Dictionary on Lexico.com." *Lexico: Powered by Oxford*. https://www.lexico.com.

Edwards, Steve. "Factory and Fantasy in Andrew Ure." *Journal of Design History* 14, no. 1 (2001): 17-33. https://www.jstor.org/stable/3527270.

F. "The Rise and Progress of Cotton Spinning." *The Dublin Penny Journal*, 1, no. 29 (January 2, 1833): 230-231. https://www.jstor.org/stable/30003112.

F. "What is a Machine?" *The Dublin Penny Journal* 1, no. 4 (February 2, 1833): 254-255. https://www.jstor.org/stable/30002852.

Fielden, John. *The curse of the factory system, or, A short account of the origin of factory cruelties, of the attempts to protect the children by law, of their present sufferings, our duty towards them, injustice of Mr. Thompson's bill, the folly of the political economists, a warning against sending the children of the South into the factories of the North.* London: A. Cobbett, 1836. https://catalog.hathitrust.org/Record/006069333.

Gaskell, Peter. *Artisans and Machinery: The Moral and Physical Condition of the Manufacturing Population, Considered with Reference to Mechanical Substitutes for Human Labor.* London: J.W. Parker, 1836. https://catalog.hathitrust.org/Record/001430047.

Gordon, Alexander. *A Treatise upon elemental locomotion, and interior communication, wherein are explained and illustrated, the history, practice, and prospects of steam carriages: and the comparative value of turnpike roads, railways, and canals*. 2nd edition. London: T. Tegg & Son, 1834. https://catalog.hathitrust.org/Record/012360652.

A Guide to the Great Exhibition: containing a description of every principal object of interest: with a plan, pointing out the easiest and most systematic way of examining the contents of the Crystal Palace. London: George Routledge and Co., 1851. https://catalog.hathitrust.org/Record/100236097.

"Hand Loom Weavers and Factory Workers." London: C. & W. Reynell, 1835. https://www.jstor.org/stable/60203199.

"Historic Cassini Mission Ends with Dramatic Dive into Saturn." *The Daily Planet: Department of Climate and Space Sciences and Engineering Newsletter*. University of Michigan, Fall 2017. http://clasp-research.engin.umich.edu/dailyplanet/2017/fall/cassini-ends.html.

Hobsbawm, Eric. *Industry and Empire: From 1750 to the Present Day*. 2nd edition. New York: The New Press, 1999.

Hobsbawm, Eric, and George Rudé. *Captain Swing*. 2014 edition. New York: Verso Books, 2014.

House of Lords. Parliamentary debate, 27th February 1812. https://api.parliament.uk/historic-hansard/lords/1812/feb/27/frame-work-bill.

Jennings, Humphrey. *Pandaemonium: The Coming of the Machine as Seen by Contemporary Observers*. Edited by Marie-Louise Jennings and Charles Madge. 2012 Kindle edition. London: Icon Books Ltd., 2012.

Kay-Shuttleworth, James. *The Moral and Physical Condition of the Working Classes Employed in the Cotton Manufacture in Manchester*. London: J. Ridgway, 1832. https://catalog.hathitrust.org/Record/011924801.

Kemble, Frances Ann. *Record of a Girlhood*. London: R. Bentley and Son, 1878. https://catalog.hathitrust.org/Record/001362908.

Ketabgian, Tamara. *The Lives of Machines: The Industrial Imaginary in Victorian Literature and Culture*. Ann Arbor: University of Michigan Press, 2011.

Ketabgian, Tamara. "Prosthetic Divinity: Babbage's Engine, Spiritual Intelligence, and the Senses." *Victorian Review* 35, no. 2 (Fall 2009): 33-36. http://www.jstor.com/stable/41038833.

Knight, Charles, and the Society for the Diffusion of Useful Knowledge. *An address to the labourers, on the subject of destroying machinery*. London: Charles Knight, 1830. https://www.jstor.org/stable/60248962.

Knight, Charles. *The Results of Machinery: namely, cheap production and increased employment exhibited: being an address to the working-men of the United Kingdom*. American edition. Philadelphia: Carey & Hart, 1831. https://catalog.hathitrust.org/Record/008596143/Home.

Kossakovski, Fedor. "Analysis: Why NASA's Cassini probe had to be destroyed." *PBS News Hour*, 13 September 2017. https://www.pbs.org/newshour/science/analysis-nasas-cassini-probe-must-destroyed.

Lee, Gerald Stanley. *The Voice of the Machines*: *An Introduction to the Twentieth Century*. New York: Doubleday, 1906. https://catalog.hathitrust.org/Record/100570739.

Sollazzo, C., J. Rakiewicz, and R.D. Wills. "Cassini-Huygens: Mission operations." *Control Engineering Practice* 3, no. 11 (Nov. 1995): 1631-1640. https://doi.org/10.1016/0967-0661(95)00174-S.

Somerville, Alexander. *The Autobiography of a Working Man*. London: Charles Gilpin, 1848. https://catalog.hathitrust.org/Record/001350912.

Southey, Robert. *Sir Thomas More, or, Colloquies on the Progress and Prospects of Society*. London: John Murray, 1829. https://catalog.hathitrust.org/Record/001186040.

Street, Andrew P. "Tracing Cassini's fiery death was like seeing a heart monitor flatline." *The Guardian*, 15 September 2017. https://www.theguardian.com/science/2017/sep/16/tracing-cassinis-fiery-death-was-like-seeing-a-heart-monitor-flatline.

Sussman, Herbert. *Victorian Technology: Invention, Innovation, and the Rise of the Machine*. Santa Barbara, CA: ABC-CLIO, 2009.

Thompson, E.P. *The Making of the English Working Class*. New York: Random House, 1963.

Turner, C.H. *Proceedings of the public meeting held at Freemasons' Hall, on the 18th June, 1824, for erecting a monument to the late James Watt.* London: John Murray, 1824. https://catalog.hathitrust.org/Record/002011672.

Ure, Andrew. *A Dictionary of Arts, Manufactures, and Mines: Containing a Clear Exposition of their Principles and Practice*. New York: D. Appleton & Co., 1844. https://catalog.hathitrust.org/Record/008631549.

Ure, Andrew. *The Philosophy of Manufactures; or, An exposition of the scientific, moral, and commercial economy of the factory system of Great Britain*. London: Charles Knight, 1835. https://catalog.hathitrust.org/Record/001430052.

The *Westminster Review*. "The article on machine-breaking, in answer to Swing." London: Robert Heward, 1831. https://www.jstor.org/stable/60213745.

Wordsworth, Dorothy. *Recollections of a Tour Made in Scotland, A.D. 1803*. Edited by John Campbell Shairp. Edinburgh: Edmonston and Douglas, 1874. https://catalog.hathitrust.org/Record/009185948.

Wordsworth, William. "The Parsonage," in *The Excursion*: *being a portion of The recluse, a poem by William Wordsworth*. 2nd edition. London: Longman, Hurst, Rees, Orme, and Brown, 1820. https://catalog.hathitrust.org/Record/001428253.