

**British Art Studies**

**April 2022**

**Thames River Works**

**Edited by Shalini Le Gall and Justin McCann**

*British Art Studies*

Issue 22, published 14 April 2022

Thames River Works

Edited by Shalini Le Gall and Justin McCann

Cover image: Hew Locke, Huan Tian Xi Di, 2016, acrylic paint on C-TYPE photograph, 124.5 × 174 cm.. Digital image courtesy of DACS/Artimage 2022 (all rights reserved).

PDF generated on 15 February 2024

Note: *British Art Studies* is a digital publication and intended to be experienced online and referenced digitally. PDFs are provided for ease of reading offline. Please do not reference the PDF in academic citations: we recommend the use of DOIs (digital object identifiers) provided within the online article. These unique alphanumeric strings identify content and provide a persistent link to a location on the internet. A DOI is guaranteed never to change, so you can use it to link permanently to electronic documents with confidence.

Published by:

Paul Mellon Centre

16 Bedford Square

London, WC1B 3JA

<https://www.paul-mellon-centre.ac.uk>

In partnership with:

Yale Center for British Art

1080 Chapel Street

New Haven, Connecticut

<https://britishart.yale.edu>

ISSN: 2058-5462

DOI: 10.17658/issn.2058-5462

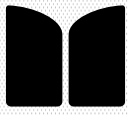
URL: <https://www.britishartstudies.ac.uk>

Editorial team: <https://www.britishartstudies.ac.uk/about/editorial-team>

Advisory board: <https://www.britishartstudies.ac.uk/about/advisory-board>

Produced in the United Kingdom.

*A joint publication by*



PAUL MELLON  
CENTRE

YALE CENTER FOR BRITISH ART

# Contents

“Over London at Night”: Gasworks, Ballooning, and the Visual Gas Field,  
Jennifer Tucker



# “Over London at Night”: Gasworks, Ballooning, and the Visual Gas Field

Jennifer Tucker

## Abstract

In 1865, the scientist James Glaisher described the way that gaslights illuminated the outline of the serpentine river Thames when seen from a balloon: “On leaving Charing Cross I looked back over London, the model of which could be seen traced—its squares by their lights; the river, which looked dark and dull, by the double row of lights on every bridge spanning it”. The Thames began to change dramatically in the early nineteenth century as a direct result of the establishment of the gasworks along the river. This article explores some of the historical forces through which the Thames became a key site where gas manufacture and ballooning came together to provide new forms of experience and spectacle; and economic opportunity as well as deadly physical risk and toxic effluent. Gas in London applied a material force, exerting a presence both through the positioning of human observer in the aerial landscape, and as a pictorial subject of art and visual documentation, rendered through fine art, watercolors, maps, and other visual records. Consideration of what I call here “the visual gas field” suggests that the docklands of the nineteenth-century Thames were not only connected by its waters, but also by a form of energy that bridged earth, air, and water with far-ranging impacts on the river’s ecology, the people who lived and worked on it, and the ways in which the river was seen and imagined.

## Authors

Historian of modern Britain at Wesleyan University in Connecticut

## Acknowledgements

I am indebted to the comments of the two anonymous reviewers and to Baillie Card, Shalini Le Gall, Justin McCann, Maisoon Rehani, and Sarah Victoria Turner at *British Art Studies*. Finally, for their assistance, I also would like to extend my thanks to the research staff at the London Metropolitan Archives and Chris Sugg (a family descendant of Thomas Sugg, who made the pipes and fitted Carlton House for Frederick Winsor in 1807) for sharing his knowledge of London’s gaslighting industry.

## **Cite as**

Jennifer Tucker, "'Over London at Night': Gasworks, Ballooning, and the Visual Gas Field", *British Art Studies*, Issue 22, <https://dx.doi.org/10.17658/issn.2058-5462/issue-22/jtucker>

## Introduction

In H.G. Wells's 1897 novel *The Invisible Man*, when asked how he achieved invisibility the eponymous protagonist replies that he discovered a "general principle" relating to "pigments and refraction", which, when applied, made him "almost as invisible as a jet of coal gas or [as] hydrogen is in air".<sup>1</sup> Most gases, though, are transparent (not invisible)—the molecules are physically small and loosely bonded—and they can have other physical properties such as taste, and smell. Some even take vivid hues. Chlorine, for example, is a greenish yellow; bromine, reddish brown; iodine, dark purple; and chlorine dioxide a potent yellow.

*The Invisible Man* was one of the era's finest studies of the conflicts between communitarianism and individualism, a theme also central to considerations of Victorian infrastructure and public space, and few modern industries captured the tensions of early nineteenth-century British industrialization—the romance and the ruin—quite as well as the manufacturing of gas along the banks of the Thames.<sup>2</sup> As historian of the early Thames gas industry Leslie Tomory has pointed out, "Gas was part of the reshaping of the urban infrastructure in the nineteenth century that created the modern city through the construction of water, sewage, rail, road, electricity, telegraph, and telephone infrastructures".<sup>3</sup>

Examining the co-creation of the industrial infrastructures of the River Thames and the gas manufacturing industry—that is, the way in which the concept of the River Thames evolved in tandem with industrial expansion—reveals the visible presence of an otherwise inappreciable state of matter with no fixed shape, and no fixed volume. To understand the Thames in the early nineteenth century, it helps to consider the physical and visual properties of industrial gas, taking into view their material and aesthetic manifestations in urban circuits of energy.<sup>4</sup> This article examines how gas manufacture in Regency and early Victorian London changed the urban landscape, and helped recast the material forms and perspectives of nineteenth-century art and visual culture.<sup>5</sup> I use the term "visual gas field" to denote the rich and varied artworks and illustrations that convey how the gas industry became present in the landscape in and around the Thames from the 1810s onwards. By visual gas field, I mean the intimate interconnections—between energy, work, and leisure, as well as risk and reward—that characterize an awareness of gas, its dangers, and its infrastructure, and that seeped into the fabric of its enjoyment and perceived modernity. Gas in London applied a material force, exerting a presence both through the positioning of a human observer in the aerial landscape, and as a pictorial subject of art and visual documentation, rendered through fine art, watercolors, maps, and other visual records. Following this reading, late

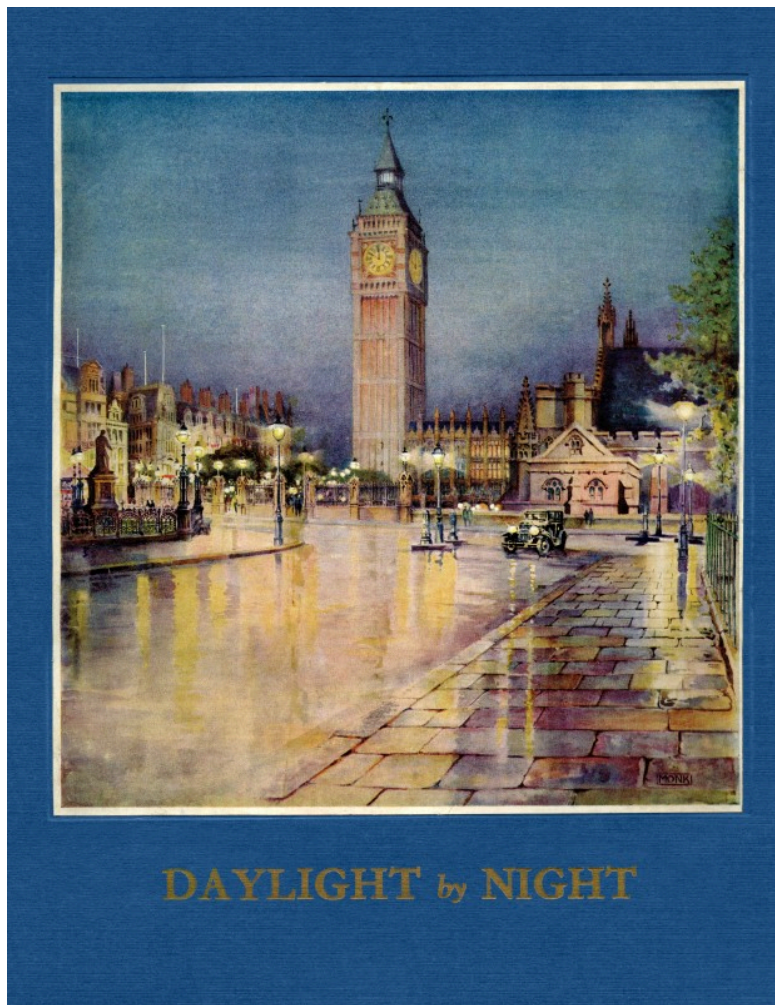
nineteenth-century artworks such as *Bird's Eye View of London and Westminster* (1884) (fig. 1) by Wyllie and Brewer, an engraving depicting a balloon flight 1,500 feet over London, as well as the much later work *Daylight by Night* (ca. 1931) (fig. 2), which illustrated the cover of a Gas Company book prepared for the annual meeting of stakeholders, can be thought of as part of this “visual gas field”, despite their differences of genre, media, and audience.



**Figure 1.**

W.L. Wyllie and H.W. Brewer, *Bird's-Eye View of London and Westminster*, taken from a balloon 1,500 feet above Westminster, in *The Graphic*, May 1884, 1884, hand-coloured engraving, 87 × 112 cm. Digital image courtesy of Christie's Images (all rights reserved).





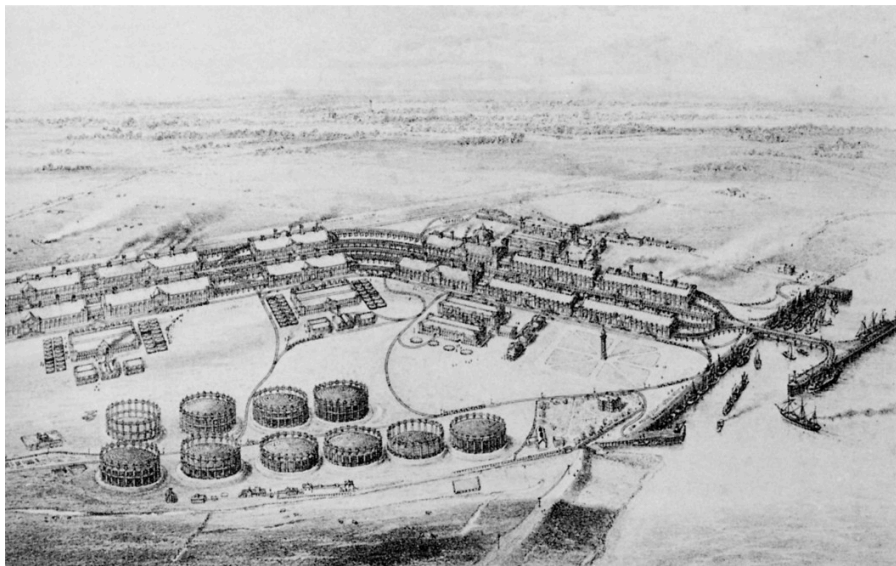
**Figure 2.**

William Monk, *Daylight by Night: A Record of Some of the Modern Installations of Gas Lighting in Important Thoroughfares in Great Britain*, cover design, (London: The British Commercial Gas Association, 1931), watercolour. Digital image courtesy of William Monk / The British Commercial Gas Association (all rights reserved).

Rivers, because of their connection to the world's first gas manufacturing industries, are also valuable sites for the study of what the historian and feminist scholar Michelle Murphy terms "chemical relations", a concept that she uses to study industrial chemical violence in the form of polychlorinated biphenyls (PCBs) that persist and circulate in the air, land, and water, and in people's bodies.<sup>6</sup> Gas engineering networks produced visual effects that environmental historian Rob Nixon has termed "slow violence", denoting violence happening over months, years, and decades rather than a single act of violence confined to a moment.<sup>7</sup> In a related way, the Thames was enmeshed in histories of chemical infrastructures that combined the sometimes violent realities of manufacture, labor exploitation, colonialism,

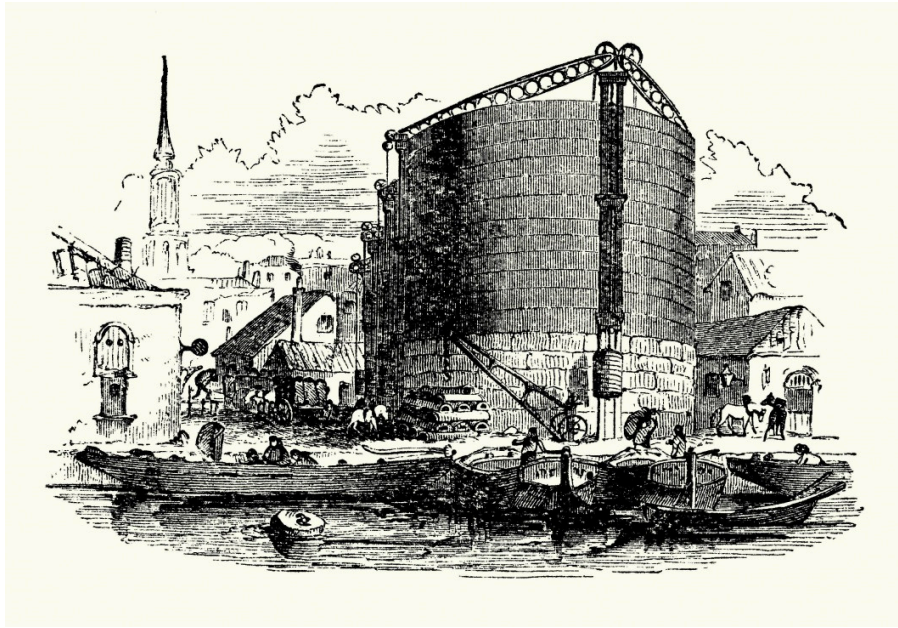
capitalism, and pollution with powerful conditions of possibility, such as light, heat, food, and beauty: “fairy-tale” settings, for art, government diplomacy, and aesthetic creation.

Gas lighting was one of the key innovations contributing to the convenience and safety of urban life in Britain’s booming Victorian cities. London’s gas-light system began in 1812 and reached most of the metropolis by the 1830s.<sup>8</sup> Virtually all gas for fuel and lighting was manufactured from coal and supplied households via municipally owned piped distribution systems. The coal was brought in by sea and fed the gasworks that lined the banks of the Thames. These industries manufactured the gas that gradually displaced oil as the predominant source of fuel for street lighting, and eventually for heating and cooking uses.<sup>9</sup> The giant cylindrical expanding tanks, rising and falling with the arrival and depletion of gas, became a striking feature of the Victorian urban landscape (figs. 3-5). Gasholders were built in large numbers around the country from the 1850s and were especially prominent along the south bank of the Thames.



**Figure 3.**

Artist's impression of the Gas Light and Coke Company's plant at Beckton, in Trevor I. Williams, *A History of the British Gas Industry* (Oxford: Oxford University Press, 1981), plate 6, 1877, drawing. Digital image courtesy of British Gas Corporation Archive (all rights reserved).



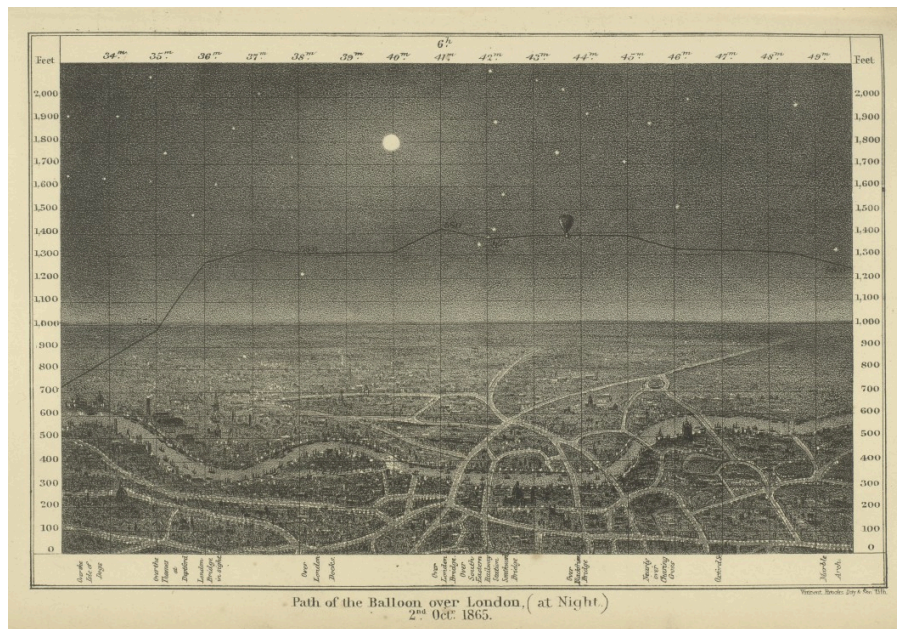
**Figure 4.** Victorian Gasworks along the Thames, circa 1890s, engraving. Digital image courtesy of M&N / Alamy Stock Photo (all rights reserved).



**Figure 5.** Dollond Terrace: A View Looking Down Towards 2-12 Dolland Street terrace housing, Lambeth, with the Kennington Gasworks, *formerly the South Metropolitan Gasworks*, on the horizon, photograph. Collection of the London Metropolitan Archives. Digital image courtesy of London Picture Archive (all rights reserved).

Coal gas was also used to inflate balloons, from which observers had a radically new perspective on the London metropolis. Anyone who has flown into London will appreciate the majestic view from the air of the Thames snaking through the city. Some criticized gas lighting for disturbing the tranquil beauty of the nocturnal world, for bringing the ugliness of industry into refined urban spaces.<sup>10</sup> But for others, gaslit London was a beautiful and romantic sight.

In 1865, 56-year-old Greenwich Observatory astronomer and meteorologist James Glaisher made a night ascent in a coal-gas-filled balloon over the gaslit streets of London. Stern, disciplined, not especially well-liked by his scientific peers nor known for light-hearted banter, Glaisher nevertheless described his view that night of a “starry spectacle” a mile below in terms so exquisite, personal, even wistful and tender that they might have belonged to a young romantic artist or poet. He wrote: “On leaving Charing Cross I looked back over London, the model of which could be seen traced—its squares by their lights; the river, which looked dark and dull, by the double row of lights on every bridge spanning it”. “It seemed to me”, he continued, “to realize a wish I have felt when looking through a telescope at portions of the Milky Way; when the fields of view appeared covered with gold-dust, to be possessed of the power to see those minute spots of light as brilliant stars; for certainly the intense brilliancy of London this night must have rivalled such a view”. The Commercial Road—constructed between 1802 and 1806 to carry traffic from the West and East India docks to the City of London—was illuminated like “a line of brilliant fire”. Glaisher published an account of his flight in his 1871 book *Travels in the Air*, a collection of essays by fliers such as the French aeronaut Camille Flammarion, and included a lithographic print showing an aerial view of gaslit London with the serpentine Thames at its center, over which is superimposed a graph showing the path of his balloon (fig. 6).<sup>11</sup> Along the horizontal axis are the locations of the balloon over the earth, as it travels through the night sky: from the Isle of Dogs in the bottom left, to Marble Arch at the right.



**Figure 6.**

Over London at Night, in James Glaisher et al., eds., *Travels in the Air* (London: Richard Bentley & Son, 1871), 81, 1865, lithograph. Collection of the National Library of Scotland. Digital image courtesy of National Library of Scotland (all rights reserved).

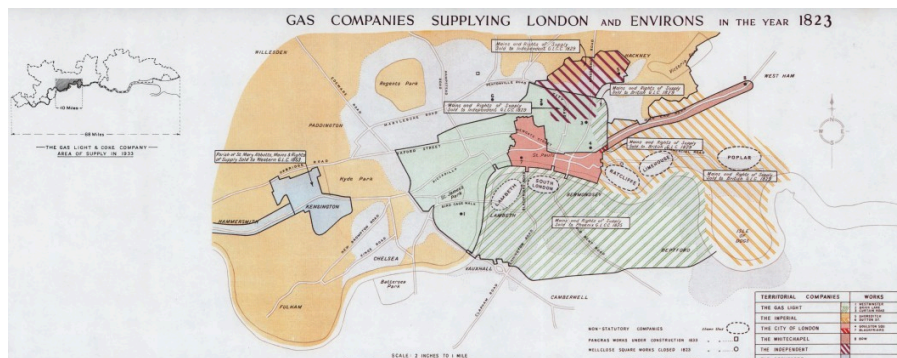
Ballooning was then—as it is now—a source of curiosity and inspiration, for diverse and complex reasons. Victorians lifted ballooning into a narrative of progress, seeing it as a powerful new tool for understanding the relationship between humans and the environment. <sup>12</sup> Gas light appeared widely in Victorian art and literature as both technologically advanced and beautiful: part of a world of enchantment, and a complex source of contradictory desires, for—and against—life in the spotlight. Yet ballooning over the Thames—as a technology of distant seeing and experience—was utterly inseparable from an industry whose infrastructure was embedded along the river, in the gritty, smelly, industrial worlds of Britain’s expanding early public gasworks, emanating from urban areas along the Thames such as Westminster, Vauxhall, Deptford, Greenwich, and Woolwich. <sup>13</sup>

As Johana Godfrey has shown, the morbidity of the Thames was captured in the opening scene of Charles Dickens’s last completed novel, *Our Mutual Friend*, published in 1865. Dickens’s narrator’s image of “the tender river” where characters die violently presents a competing image to James Glaisher’s wondrous view of the Thames in “Over London at Night”. In the narrator’s opening of *Our Mutual Friend*, Gaffer Hexam—a waterman who makes his living by finding and retrieving dead bodies from the

Thames—pulls a corpse out of the river at night and berates his daughter: “It’s my belief you hate the sight of the very river. ... As if it wasn’t your living! As if it wasn’t meat and drink to you!” <sup>14</sup>

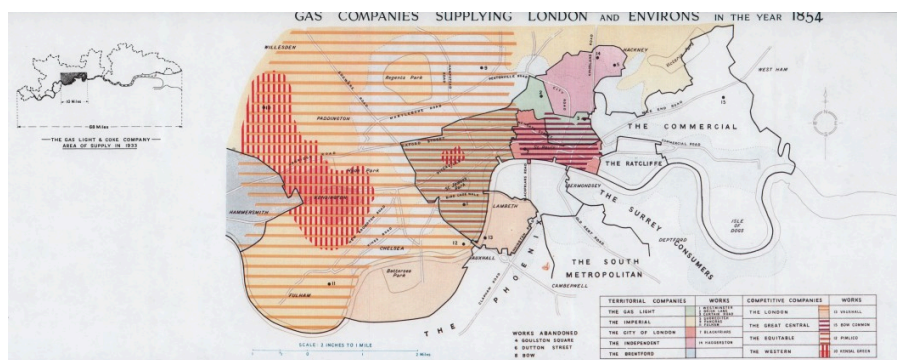
## Arrival of Gasworks on the River Thames

Over the course of the eighteenth and nineteenth centuries, watery spaces like the Thames bore the demand of energy systems on land. The Thames began to change dramatically in the early nineteenth century as a direct result of the establishment of the gasworks along the river. Around this time, the gas networks began to supply ever-widening districts of the city, north and south of the Thames, as depicted in two mid-twentieth-century colored maps of the gas network districts (figs. 7 and 8).



**Figure 7.**

Map of Gas Undertakings: Gas Companies Supplying London and Environs in the Year 1823, in Stirling Everhard, *The History of the Gas Light and Coke Company 1812–1949* (London: A & C Black Publishers, 1992), facing page 96. Digital image courtesy of A & C Black Publishers (all rights reserved).

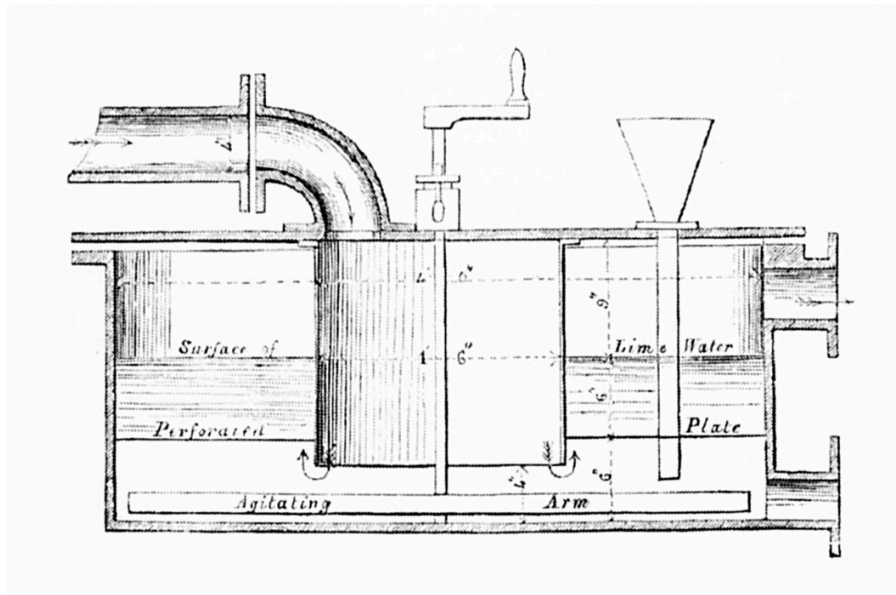


**Figure 8.**

Map of Gas Undertakings: Gas Companies Supplying London and Environs in the Year 1854, in Stirling Everhard, *The History of the Gas Light and Coke Company 1812–1949* (London: A & C Black Publishers, 1992), 176. Digital image courtesy of A & C Black Publishers (all rights reserved).

The possibilities of coal gas had first been explored in the eighteenth century. In 1792, Scottish engineer and inventor William Murdoch (1754–1839), one of the first to apply coal gas to the purpose of artificial illumination, used coal gas to light his own house, at Redruth in Cornwall, as well as a steam carriage he used to travel between the various mines he managed. In 1798, Murdoch illuminated part of the Soho Foundry of Messrs. Boulton, Watt, and Co. in Birmingham.<sup>15</sup> In 1803, the entrepreneur Frederick Albert Winsor (later anglicized to Winsor) arrived in London from Brunswick, Germany, and proceeded to make many public physical demonstrations to prove his knowledge of gas. He flooded the capital with pamphlets on gas lighting and lectured on the subject at the Lyceum Theatre. In 1804, he obtained a patent for an improved apparatus for extracting air, oil, pitch, tar, and acids from coke and charcoal. The inflammable gas could be used to produce light and heat. In 1807, Winsor lit Pall Mall with his product, a project launched with an elaborate public display.<sup>16</sup>

The Manchester engineer Samuel Clegg (1781–1861), widely known for his technical contributions to gas manufacturing, was another early innovator and used gas to light factories in Halifax and Manchester.<sup>17</sup> The wet lime purifier that he developed (the better-known dry process did not appear until later) was designed to separate hydrogen cyanide and hydrogen sulfide (fig. 9). (If not removed, hydrogen sulfide could lead to the formation of sulfuric acid, which corroded gas fittings and property inside houses). In use after it was introduced by Clegg in 1812, the wet lime purifier had drawbacks: it produced a waste product known as “Billy Blue”, a blue wet lime waste that was sharply pungent, which created problems for transportation and removal.

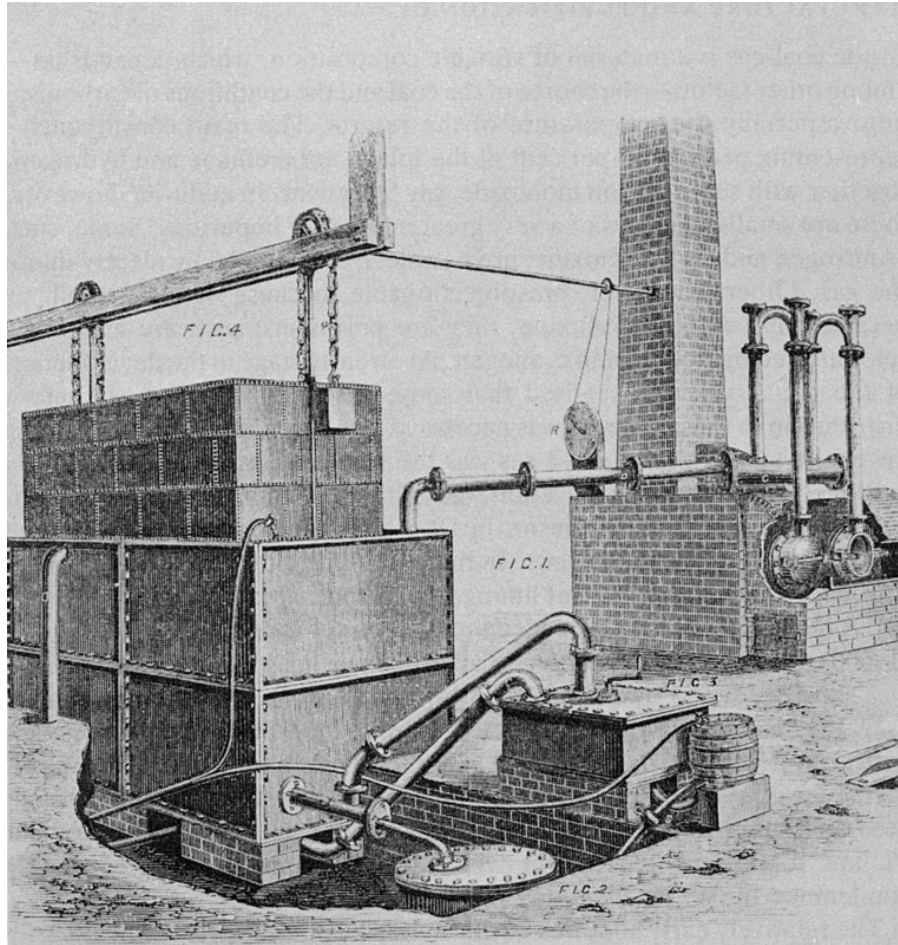


**Figure 9.**

Samuel Clegg, Design for a Wet-Lime Purifier (cross section), in Samuel Clegg, *A Practical Treatise on the Manufacture and Distribution of Coal-Gas* (London: John Weale, 1841), fig. 5, circa 1820. Digital image courtesy of British Gas Corporation Archive (all rights reserved).

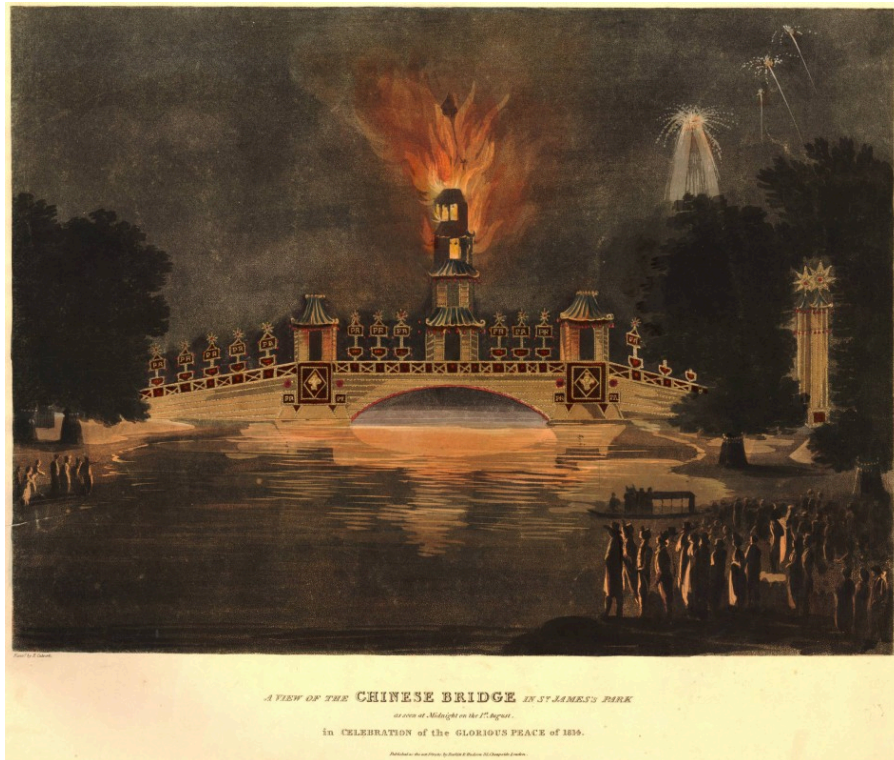
The London and Westminster Gas Light and Coke Company was incorporated in 1810 and was granted a Royal Charter in 1812. It built the first gasworks along the banks of the Thames, and by 1815, thirty miles of gas lines had been laid.<sup>18</sup> Gas distribution was through cast iron mains (some of them made from recycled musket barrels), with the pressure regulated by valves (referred to as 'governors') (fig. 10). Public street lighting was expanded to Westminster Bridge on 31 December 1813. Festive public illuminations took place throughout Britain. A seven-story Chinese Bridge and Pagoda lit by 10,000 gas burners was erected in St. James's Park to celebrate the end of the war with France in 1814 and the centenary of the ascension of the House of Hanover to the British throne (fig. 11).<sup>19</sup> Unfortunately, the gas-illuminated pagoda formed the centerpiece of a huge firework display and caught fire during the celebrations, causing two deaths and a number of injuries to the men who were supervising the display, and showing again that gas could mean both entertainment and risk.





**Figure 10.**

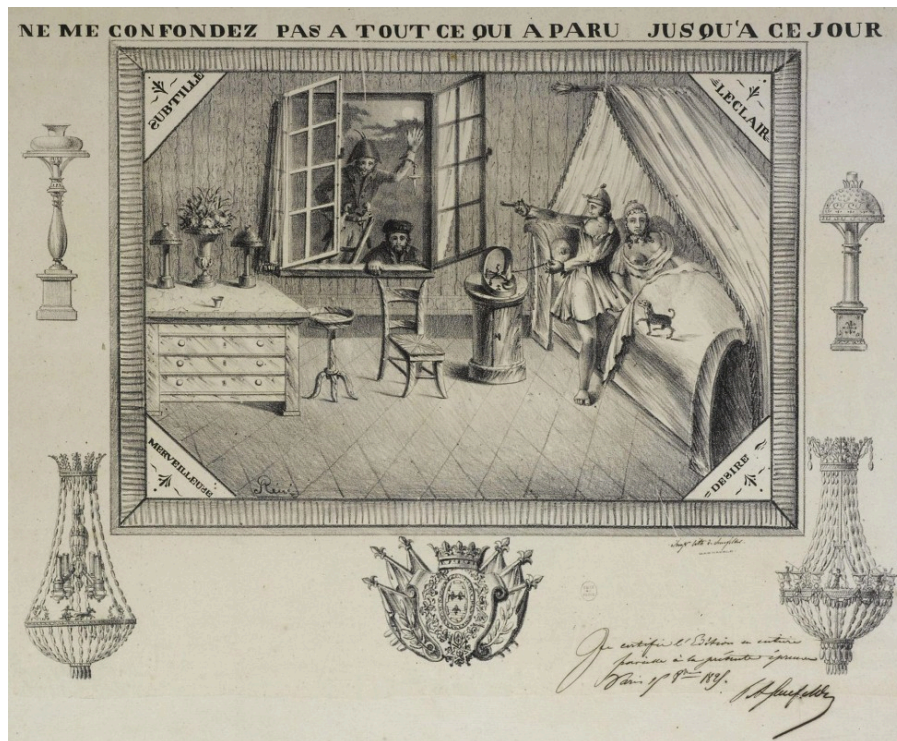
Gas Works Constructed by Samuel Clegg for Ackermann's Repository of Fine Arts in the Strand, 1812, in Trevor I. Williams, *A History of the British Gas Industry* (Oxford: Oxford University Press, 1981), fig. 1. Digital image courtesy of The Trustees of the British Museum (all rights reserved).



**Figure 11.**

After Frederick Calvert, *A View of the Chinese Bridge in St James's Park*, 1814, hand-coloured etching and aquatint, 41.7 × 49.2 cm. Collection of The British Museum (1880,1113.2380). Digital image courtesy of Digital image courtesy of The Trustees of the British Museum (CC BY-NC-SA 4.0).

The coming of gas was welcomed not only for its festive powers of illumination but as an essential public service. By 1820, gas lighting was being installed in Paris, and in Manchester by 1824. As the leading mid-twentieth-century historian of the British gas industry Stirling Everard put it in *The History of the Gas Light and Coke Company, 1812-1949*, "London was a city of narrow streets, courts and alleyways, full of dark corners that at night provided hiding places for petty thieves and pickpockets. ... The more progressive Authorities were quick to see the advantages of brightly lit streets in preventing crime, particularly if the lighting could be obtained at lower cost than that of oil. The coming of gas was hailed as an event of major importance, and the new industry was welcomed as an essential public service".<sup>20</sup> An 1823 poster for gas lighting emphasized the new mastery it would give customers over the environment: it shows a man jumping out of bed, turning up the gas light, and aiming his gun at an intruder, all in a single instant (fig. 12).<sup>21</sup> Initially city authorities granted monopolies, but increasingly after 1830, multiple licenses were granted. This led to ruthless competition, which ranged from predatory pricing to the sabotage of rival firms' gas mains.<sup>22</sup>



**Figure 12.**

René, *Ne me confondez pas a tout ce qui a paru jusqu'a ce jour*, 1829, lithograph, 42 × 52.5 cm. Collection of Musée Carnavalet, Paris. Digital image courtesy of Musée Carnavalet, Paris (CC0 1.0)

## Noxious Neighbors

The development of the gas industry created urgent environmental problems, making it particularly unwelcome to the human and animal residents of the Thames and its banks, who were—in the words of historian Vanessa Taylor—“involuntary neighbors” of riverside energy infrastructure.<sup>23</sup> Gas production and distribution introduced noxious odors and caused disruption as engineers tore up the streets to lay mains. Gas itself is transparent, but its effects were all too tangible. Gasworks belched coal smoke from their furnace chimneys almost constantly, and emitted ground-level smoke and fumes whenever the retorts were opened to be cleaned of coke and loaded with fresh coal.<sup>24</sup> A hand-colored etching and aquatint by W. Read, illustrating men at work in a gasworks at Brick Lane, London, was the frontispiece of the 1821 volume of the *Monthly Magazine* (fig. 13).<sup>25</sup> It depicts gasworkers laboring at night to syphon off the crude gas generated in the retorts—containers in which coal or other material was heated in ducts and channels in order to manufacture gas. The scene of coal being transformed into gas by heating is almost mystical, even nightmarish, with its portrayal of workers encased by machinery, dynamical pipes, clouds of fumes, and reddish flames, and supervised by a shadowy overseer. The

artist's use of color dramatizes a scene that conveys the tension of chaos versus process and control; orange-red flames open towards the workers, who lunge against them like soldiers holding a line. The art historian Francis Klingender, discussing this print in relation to other contemporary illustrations that "gave industry the image of Hell", wrote that Read's aquatint offered an "infernal sight".<sup>26</sup>



**Figure 13.**

W. Read, Drawing the Retorts at the Great Gas Light Establishment at Brick Lane, frontispiece in *The Monthly Magazine*, February 1821, 1821, aquatint, 19.6 × 24.7 cm. Digital image courtesy of Wikimedia (public domain).

Gasworks had especially adverse effects on rivers. Works were typically located adjacent to rivers to simplify the disposal of fluid waste products, which contained sulfuric acid, tar, and ammonia among other substances. In London, these went straight into the Thames, poisoning aquatic life and contributing to the demise of livelihoods that depended on fishing. The effluent from the gasworks was described as a "great evil" by many; and the full extent of the problem was elaborated by Thomas B. Simpson in *Gas-Works: The Evil Inseparable from Their Existence in Populous Places, and the Necessity for Removing Them from the Metropolis, as has been done in Paris*, published in 1866—a book that left little to the imagination about where Simpson stood on the issue.<sup>27</sup> The book included comments from the press and evidence from physicians on the poisonous and destructive effects of gasworks; parliamentary inquiries; and local petitions that criticized metropolitan gas companies for manufacturing gas in cities, suburbs, and other places where there were dense populations. Simpson made gas

production visible to readers not through visual representations but through vivid prose descriptions of ever-present calamity and “terrific proof”: from violent explosions with “causes which may occur at any moment of the day or night” that spread ruin “with the rapidity, and with a hundred times the destructiveness, of a terrific lightning-stroke”;<sup>28</sup> to more gradual forms of violence, such as “sanitary mischief”, stench, and injurious effects on health that, Simpson acknowledged, were still not clearly understood by medical science.<sup>29</sup> For Simpson, the gasholder was a “useful but terrible monster”, despite the common view, still current in 1866, that it was a marvelous “wonder”.<sup>30</sup>

As urban historian Jean-Baptiste Fressoz has suggested, the general picture of a postmodern “risk” society as opposed to the “progress” society of the nineteenth century must be questioned, given that industrializing societies of the nineteenth century were also often well aware of the risks brought by innovations. Indeed, he shows that a critical attitude toward technological progress appeared in the writings of opponents of gas lighting. Indeed, in 1865, following a fatal disaster at the London Gas Light Company works at Nine Elms in Vauxhall, near the present site of the Battersea Power Station, a reporter for the *Morning Herald* contrasted the vigilance of the public with regard to precautions around the “deadly” manufacture of gunpowder with the casual way that explosive gas materials were accumulated in the heart of the city, observing the “alarming fact” that London “is sprinkled from its centre to its outskirts with these prodigious bombshells [gasholders], which may explode mysteriously at any moment of the night or day, with awful havoc to human life and to property”. No one in the region of a gasholder was safe: “Millions of feet in cubic feet are filled, every twenty-four hours, with the detonating force, and a flaw of workmanship, a trifle of omission, the inadvertence of a minute, or an error in mechanical judgement, may make a suburb tremble and crowd an hospital with sufferers”.<sup>31</sup> Following the inquest into the deaths of ten workers from the gas factory (seven men on site, three who died later at the hospital), a *Daily Telegraph* reporter urged on 4 November 1865 that the issue of gasworks at Vauxhall be brought before Parliament, saying that “The awful gas explosion at Nine Elms, with all its horrible accompaniments of sudden death, mutilation, widespread terror, individual misery, and wholesale destruction of property” demanded the “serious attention” of the House of Commons.<sup>32</sup> The *Evening Standard* (2 November 1865) supplied even more graphic details, pointing out that while the London Gas Company’s gasometer had been praised as “faultless in point of construction”—“made with all the modern improvements, of the best material, and in the most perfect possible manner”—this “triumph of gas engineering” was now a “shapeless wreck, its stout iron sides are torn to ribbons, or crumbled up like pasteboard”, and with damage to property within a mile of the scene of the explosion that

showed “its effect upon the locality”. London city dwellers could not help but be reminded, the *Evening Standard* reporter concluded, of “the dangers of crowded cities in the days of chemical science and mechanical discovery”.<sup>33</sup>

Whereas the Thames was once a rich source of fish and food, supporting the livelihoods of thousands of people, the gassing of the river affected neighborhoods and neighbors, and fish populations began to dwindle and collapse. By the late 1820s, many of those who fished in the Thames and their families faced food scarcity and starvation due to the decline in local fish populations.<sup>34</sup> Antagonistic relations over fish, property, smells, and other risks and disturbances were mediated by law and contracts, patents, petitions, and parish churches, and labor strikes generated further challenges.<sup>35</sup> Already in the 1820s, for example, the City of London Corporation had filed nuisance lawsuits against the gas companies. In liberal nineteenth-century England, it was thought that regulation would tie the “invisible hand” from working as it should. An example of this, noted by Fressoz, is the Dorset Street gas factory, located in Spitalfields, East London, which was forbidden to use the river to get rid of its liquid wastes, and obliged to use dry lime in place of water lime for gas purification. As a result, its gas was less pure and more dangerous for consumers. A local nuisance that killed fish had been suppressed but, as Fressoz noted, the gas that the company now distributed to its customers was even more dangerous.<sup>36</sup>

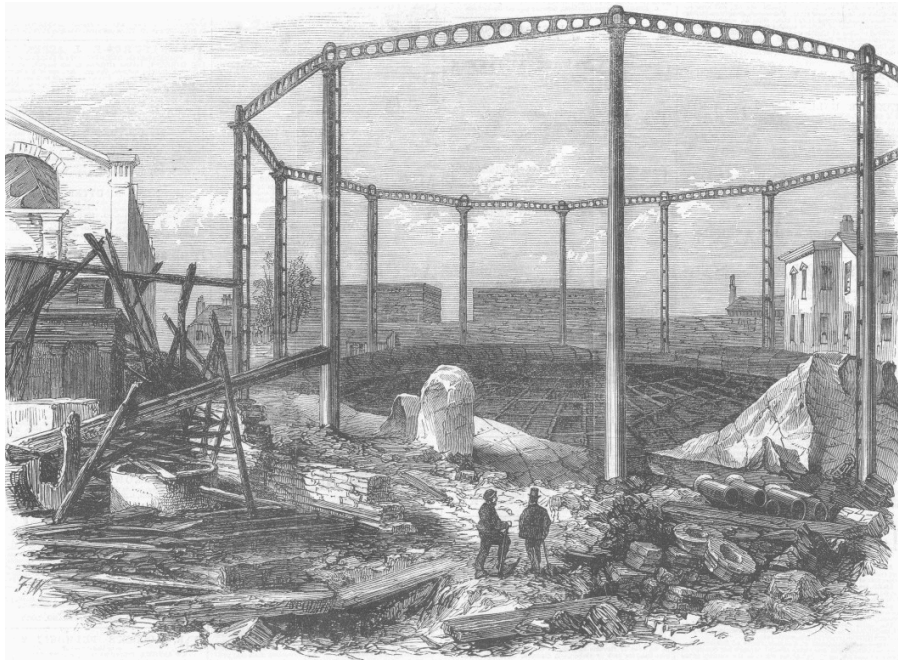
In August 1820, a group of Thames fishermen and their families and other allies petitioned the lord mayor, the oldest fishermen complaining that—as they recorded—it was “no longer possible for fish to live in the river, in consequence of the offensive stuff which flows into the Thames from the pipes formed by the Company to let off the refuse”.<sup>37</sup> The Courts of Conservancy visited the outfall pipes of the gasworks, had the Thames dragged to collect soil, and collected bottles of effluent to show the mayor. Their representatives conducted experiments at Thameside, including one in 1821 in which numerous fish died in the mayor’s presence after only one minute’s exposure to “gas-water” (also called “scum”) containing residuum from the gasworks. (An eel survived for only four minutes.) At the Croydon assizes in July 1821, the directors of the South London Co. were found guilty of causing a nuisance, but since they had taken steps to reduce the flow of effluent, the judge fined the directors only £5 each.<sup>38</sup>

The rest of the decade saw many more cases of gas pollution, indictments, and convictions as the City of London strove to control gas industry pollution. But the gas companies simply paid the fines, made some temporary changes, and then returned to the release of toxic effluent.<sup>39</sup> By the end of the 1820s, the failure to control gas pollution had wreaked havoc on the Thames fishery: the number of fishing boats had halved, and the salmon

catch, which used to be 10,000 a year, had disappeared completely. One newspaper reporter made the utilitarian argument that “the advantages derived from gas considerably overbalance the profits and convenience of the Thames fishery”, while recognizing that “the mischief done to the poor fishermen has been unparalleled”. <sup>40</sup>

The problems of the gas industry were not confined to fish. London residents faced noxious smells and the risk of explosion. More than sixty gas explosions in London were reported in newspapers between 1815 and 1858; many more are likely to have occurred. <sup>41</sup> Sir William Congreve, the inventor of gas meters used for measuring the volumetric flow of gases, was appointed by the government in 1822 to investigate the danger of gasworks explosions; for example, their vulnerability to attack by anti-monarchical revolutionaries. Congreve was not a disinterested observer, however, since he had a financial interest in the Gas Light and Coke Company. Specialists in these emerging fields hired to undertake government studies for public institutions often had financial ties to the same interests. <sup>42</sup>

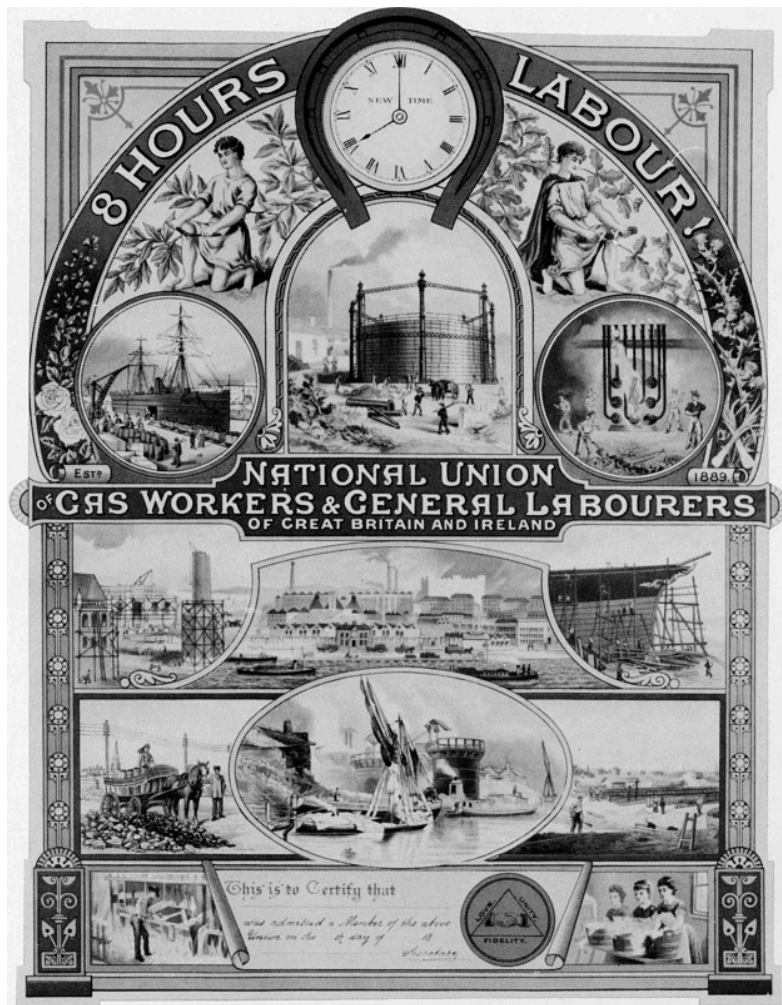
This controversy led to the first regulation of gas lighting in 1823, following an investigation by the House of Commons Select Committee, which heard evidence from scientists and engineers as well as industry representatives. As gas mains began to radiate across the city, concern also widened that with the wonders of new gas technology came new dangers, and the need for public regulation. Gas regulation acts were passed in 1847 and 1859, but the “gas agitation” (as it became known) grew stronger after a deadly explosion at the Nine Elms Gas Works in 1865 ([fig. 14](#)). <sup>43</sup> In 1872, a London Gas Board was finally established to control the quality of gas. By the end of the nineteenth century, some of the iron gas containers were bigger than St. Paul’s Cathedral. Whereas medieval churches had been the icons of an earlier Thameside age, these huge gasholders were the visible components of a new technological-urban system, whose physical infrastructure dominated the landscape. They included the gasworks where tons of coal were gasified daily and where a network of mains originated, with branches spreading out under city streets and feeding gas lamps in streets, homes, shops, parks, and public buildings. The many different aspects of gas manufacture were perhaps hidden to the majority of consumers; however, for gas workers who labored around the clock, and struggled for the right to an eight-hour day, gas was a complex and interconnected industry ([fig. 15](#)).



**Figure 14.**

News Engraving (from a photograph) of the Nine Elms Disaster, in *Illustrated London Times* 47, no. 1342, 11 November 1865, 465, 1865, engraving, 23.9 × 17.4 cm. Digital image courtesy of Antiqua Print Gallery / Alamy Stock Photo (all rights reserved).





**Figure 15.**

Certificate of the National Union of Gas Workers and General Labourers, with the clock at the top denoting the achievement of the eight hour day, in Trevor I. Williams, *A History of the British Gas Industry* (Oxford: Oxford University Press, 1981), frontispiece, unknown. Digital image courtesy of British Gas Corporation Archive (all rights reserved).

## A “Fairy-tale Palace”

Gas, then, pervaded the worlds of leisure, entertainment, and work along the Thames in the nineteenth century, shaping and structuring life along its serpentine, dynamic waterways. An awareness of gas infrastructure and its risks seeped into the fabric of its enjoyment and modernity as well. Even as gasworks were poisoning the Thames, a cheery message came from the impresarios of gas lights, who included manufacturers, distributors, and many of the gas industry’s new and growing number of consumers. Many

praised the results of gas lighting as a modern phenomenon that was, simultaneously, magical. A German traveler to London in 1820 compared the “whole of London at night” to “a fairy-tale palace”:

All the streets of London, as well as most shops, public buildings and many private houses are illuminated [with gas lights], so that the whole of London at night resembles a fairy-tale palace. For this beautiful and beneficent invention, a daughter of chemistry, we have the English to thank. <sup>44</sup>

Because of gaslit streets, the Thames and its surrounding docks became the source of new, modern desires and urban spectacle. Gas was also the progenitor of balloon views that created the very conditions for seeing the city in new ways. <sup>45</sup>

The Thames was the conduit to Vauxhall and its pleasure gardens on the southern bank. The Spring Garden was opened to the public shortly after the Restoration, probably in 1661, and it evolved into one of the four great London gardens of the eighteenth century. It was laid out with walks and arbors and garden alleys; there was a rotunda, an orchestra, and triumphal arches. Music performances were added; by the 1680s it was well known—and a little notorious—for fashion, intrigue, and sexual encounters. Samuel Pepys recorded in his diary how, on 7 June 1665—“the hottest day that ever I felt in my life”—he took water to the Spring Garden at Fox-hall and there stayed, pleasantly walking, eating lobster and syllabub, until late in the night. <sup>46</sup>

By the early 1800s, according to a late nineteenth-century historian of London pleasure gardens, Vauxhall Gardens was—with its “great concourse of high and low, its elaborate concerts, its lamps and brightly painted supper-boxes”—much larger and grander than the simple garden in which Pepys had rambled, and crammed with commercial entertainments, though some delights (gardens, food, and music) remained. Even before the age of gas, over 1,500 lamps enabled festivities to continue well into the night. Firework displays were a regular feature. The area was connected to the northern bank of the Thames with the completion of the Vauxhall Bridge in 1816. On 28 May 1822, it received the designation “The Royal Gardens, Vauxhall” and welcomed more than 137,000 visitors. The event featured emblematic illuminations, with over 11,000 lamps, and was a place associated with “idyllic sociabilities” and mixing of high and low culture. <sup>47</sup> After nearby gasworks opened in 1832, one of its chief attractions became the launch of balloons filled with coal gas supplied by a special pipe ([fig. 16](#)).



**Figure 16.**

Anonymous, Balloon Ascent at Vauxhall Gardens in 1849, in Thornbury et al., *Old and New London, 1873-1878*, Vol. 6, 463, 1870s, hand-coloured engraving, 18.4 × 26.2 cm. Collection of the Victoria and Albert Museum, London (E.4770-1923). Digital image courtesy of Victoria & Albert Museum, London (all rights reserved).

Hundreds of nineteenth-century travelers soon ascended into the air in coal-gas-filled balloons, seeking aerial, panoramic views of the Thames and surrounding countryside.<sup>48</sup> Aerostatic vision—the gaze from a balloon or airship—was a “powerful form of elevated view”, writes historian Jonathan Potter. It “corresponded” in many ways with “the far-seeing vision of the panorama”, which created “an illusion of tangible reality”; and with magic lantern shows, particularly the phantasmagoria, which “openly made visible the ephemeral, intangible, and even the invisible (e.g. spirits and ghosts)”.<sup>49</sup> Historians Martyn Barber and Helen Wickstead note that “Visibility over the capital was often commented on by balloonists, along with the more breathable air encountered at altitude”.<sup>50</sup> Aerial views, they write, “are sometimes understood as inherently map-like and surveillant as if the airborne viewer always saw in a certain way”. Yet, they note, early balloonists and their passengers “describe a London whose aspects could be revealed or disguised, elevated or debated, by different kinds of viewing”.<sup>51</sup>

Other visual technologies multiplied and commodified aerial views. The first successful aerial photograph was taken in December 1858 by the French photographer Nadar, when he captured an image in a glass plate while aloft

in a hydrogen-gas-filled balloon tethered a couple of hundred feet above the outskirts of Paris. Five years later, he launched the world's largest hydrogen-gas-filled balloon, *Le Géant*, which contained a printing room and photographic office—a reminder that the visual gas field includes not just images of gas production but also gas enabling the production of images. The first photographs over England were made that same year, during an ascent over the River Medway in May 1863 by the Italian-born scientific instrument maker Henry Negretti (1818–1879), a flight that began at a gasworks in Lower Sydenham.<sup>52</sup> Patrick Ellis suggests that the “Panstereorama”, a form of nineteenth-century urban relief model placed on display as a public spectacle, served “as a proxy for the view obtained from the increasingly popular balloon trip”.<sup>53</sup>

It is often remarked that new technologies, such as the balloon, gave expression to new ways of seeing, which were being articulated in nineteenth-century literature, social reform, art, and other visual discourses.<sup>54</sup> Yet study of the “techniques of the observer”, to use Jonathan Crary's term, can only take us so far in understanding the complex links that connected seeing, industrialization, and hierarchies of vision in nineteenth-century society. For example, the way that new technologies of seeing—from photography to printmaking to ballooning and more—were by-products of new industrializing, extractive processes merits more study. In this case, new experiences of aerial seeing are, as I have suggested, themselves, the by-products of the dramatic expansion of the London manufacture and distribution of gas.

### **Ballooning at Vauxhall (1830s–1850s)**

The first balloons that lifted off from Vauxhall at night were based on the heated air concept pioneered by the Montgolfier brothers, who inspired intense interest in ballooning across the world following their first ascent in a hot-air balloon, made in Paris in 1783. By about 1800, however, hot air balloons were displaced by balloons that mixed hydrogen and air, and by the 1830s, those were displaced by coal gas balloons that used a mixture of hydrogen, carbon monoxide, methane, and other calorific gases. Although balloons were associated with airiness, escape, and Romanticism, they were also a part of the Industrial Revolution, and rapidly became entirely dependent on gas manufacture. Vauxhall was a key site where gas manufacture and ballooning came together to provide new forms of experience and spectacle.

Experiments in using coal gas to fill balloons began in earnest in the 1780s. It was realized that a gas lighter than air, such as hydrogen (discovered in 1766 by Henry Cavendish, an English natural philosopher and chemist, and

termed by him “inflammable air”), was a useful alternative to hot air, and the Belgian natural philosopher Jan Minckelers, a professor at the University of Louvain, examined the possibilities of using coal gas for ballooning. In 1784, Cavendish filled an old gun barrel with powdered coal and heated it to produce gas. This was used to fill a small, unmanned balloon, which made a flight of twenty-five kilometers. <sup>55</sup>

The eighteenth-century proprietors of Vauxhall Gardens seized on the attractive possibilities of balloons as urban entertainment early on. In 1787, the park’s newly decorated balloon rooms were opened, designed for socializing at ascents. On 20 June 1802, a Grand Gala was held at Vauxhall Gardens that featured a free-floating hot air balloon ascent by the balloonist, inventor, and official Aeronaut of France, André-Jacques Garnerin (1769–1823)—an event complete with fireworks. Garnerin followed up the extravaganza with a balloon journey of three hundred miles, starting from Vauxhall; his student, Jeanne Geneviève Labrosse, whom he later married, was in the late 1790s one of the first women to pilot a balloon, and widely thought to be the first woman to parachute from a balloon, from an altitude of 900 meters. <sup>56</sup>

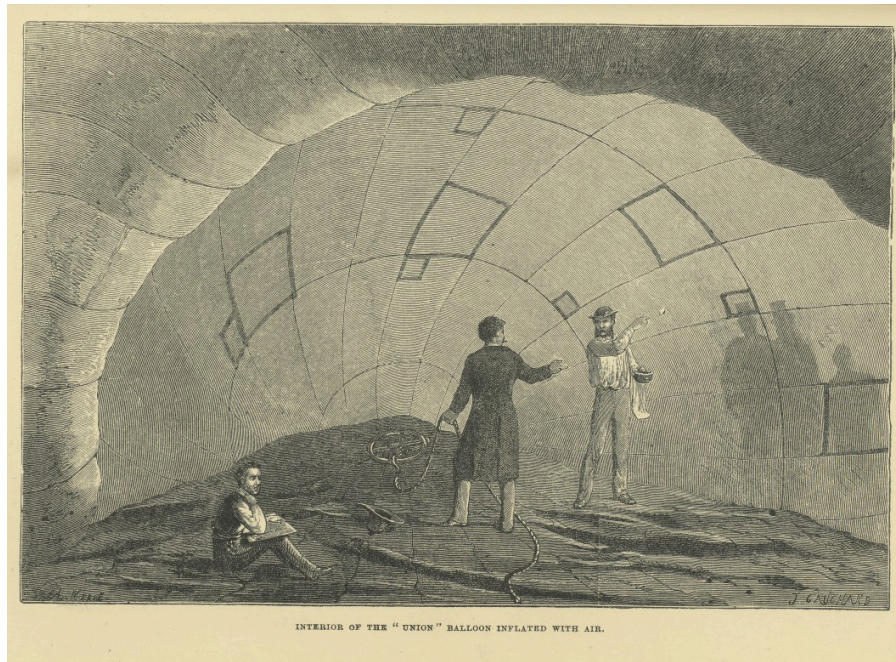
The star aeronaut along the Thames at the time was the most celebrated British balloonist of his generation: Charles Green (1785–1870). In 1821, Green made the first ascent in a balloon filled with carburetted hydrogen gas (or coal gas), from the new gas mains in London, to mark the coronation of George IV ([fig. 17](#)). That particular trip ended in crisis as he had to be rescued, but his future ascents, which were far more successful, attracted hundreds of thousands of spectators over the next three decades. <sup>57</sup>



**Figure 17.**

The New London Bridge, as it Appeared on Monday, August 1st, 1831, at the Ceremony of Opening by their Majesties, showing a balloon possibly piloted by Charles Green, witnessed by William IV, published August 15, 1831 by J. McCormick, 1831, coloured engraving. Collection of the Library of Congress (LOT 13405, no. 4 [P&P]). Digital image courtesy of Library of Congress (public domain).

The very operation of filling the balloon with gas, which often took several hours, was a modern urban spectacle and form of public entertainment that required considerable supporting labor, led by predominantly working-class men. Contemporary images of workers inflating gas balloons capture the interconnection of labor, risk, infrastructure, and leisure that permeates the visual gas field. Balloon inflation was itself the subject of art and visual record in the nineteenth century, with several depictions of balloons being filled with gas prior to their ascent in illustrations, including engravings that are reproduced in Glaisher's book, *Travels in the Air*.<sup>58</sup> Eager audiences often had to wait quite a long time for balloons to fill with coal gas; the material presence of the gas becoming visually apparent to audiences only as the volume of the balloon expanded. The smells given off, like the stench of rotten eggs, as well as the creaking sounds of ropes and pulleys and shouts of workers holding the lines, also made the coal gas a tangible presence. In one print, men are shown in the interior of the balloon, seemingly pointing to an audience outside who are visible only as shadowy figures—an image that captures a kind of pressure from an audience, almost as if waiting impatiently behind a stage curtain for a spectacle (fig. 18).



**Figure 18.**

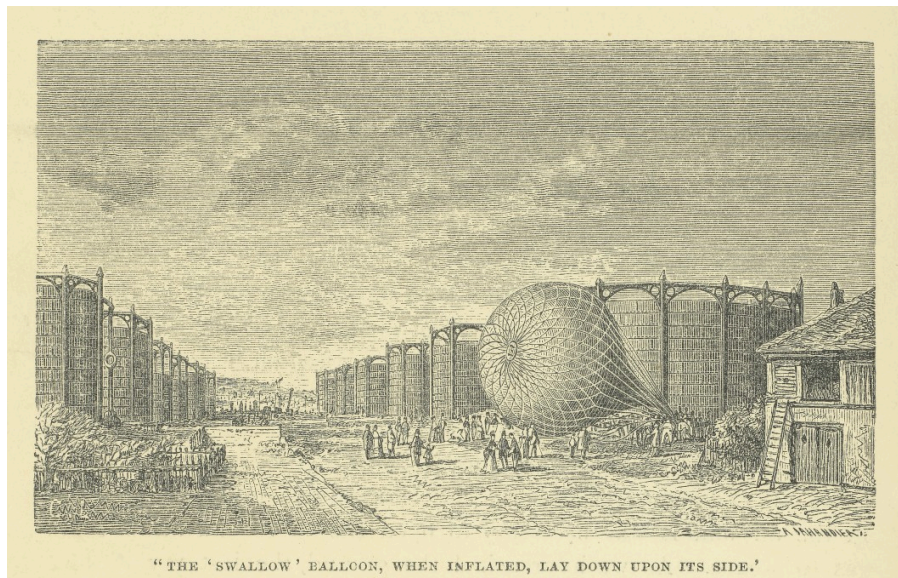
F.J. Gauchard, Interior of the "Union" Balloon Inflated with Air, in *Travels in the Air* (London: Richard Bentley & Son, 1871), 357, 1865, woodcut engraving. Collection of the National Library of Scotland. Digital image courtesy of National Library of Scotland (all rights reserved).

The process of inflation, and its depiction in these illustrations, points to public fascination with the balloons, and the possibilities offered by this new form of transportation. In a basic sense, the balloon gave form to a formless gaseous substance. Although its chemical and flammable properties were widely known, the invisibility of gas challenged public perceptions of how this substance could exist in the known/visible world. In the illustration *Filling a Balloon*, men form concentric circles around the balloon, suggesting both its impending expansion and the necessity for surveillance (fig. 19). In *The Swallow Balloon*, one observes how gas can wreak havoc with the direction and shape of the balloon, which floats askance alongside neatly lined gasholders (fig. 20). An image of a balloon within the glass structure of the Crystal Palace again reinforces both its size and technical properties, as the invisibility of gas corresponds to the transparency of the modern glass structure (fig. 21). Combined, these renderings show how the balloon was both a modern marvel that could be leveraged and enjoyed for aerial transport, and a technological feat that corralled and visualized the invisible substance flowing under the streets of London. <sup>59</sup>



**Figure 19.**

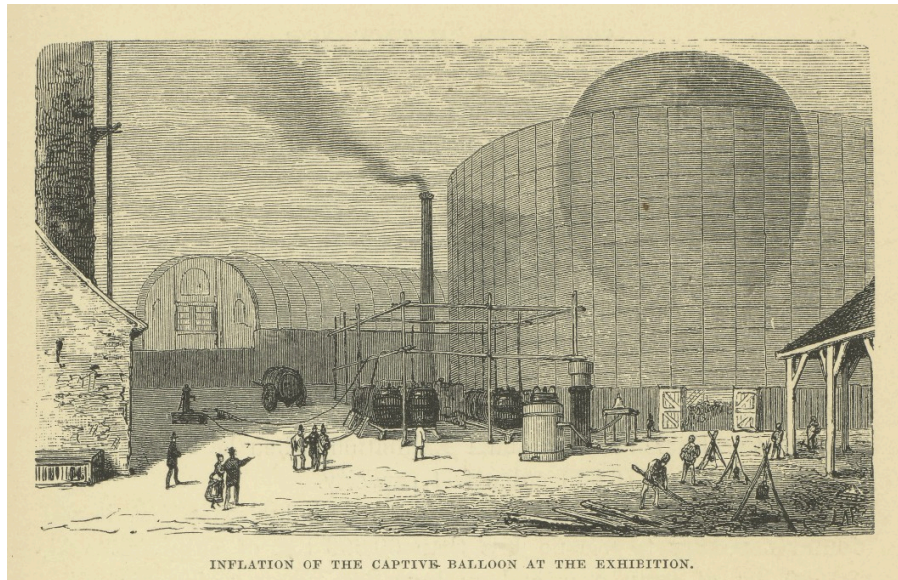
Filling a Balloon, in *Travels in the Air* (London: Richard Bentley & Son, 1871), 78, 1865, woodcut engraving. Collection of the National Library of Scotland. Digital image courtesy of National Library of Scotland (all rights reserved).



**Figure 20.**

C. Laplante, The Swallow Balloon, When Inflated, Lay Down Upon Its Side, in *Travels in the Air* (London: Richard Bentley & Son, 1871), 346, 1865, woodcut engraving. Collection of the National Library of Scotland. Digital image courtesy of National Library of Scotland (all rights reserved).

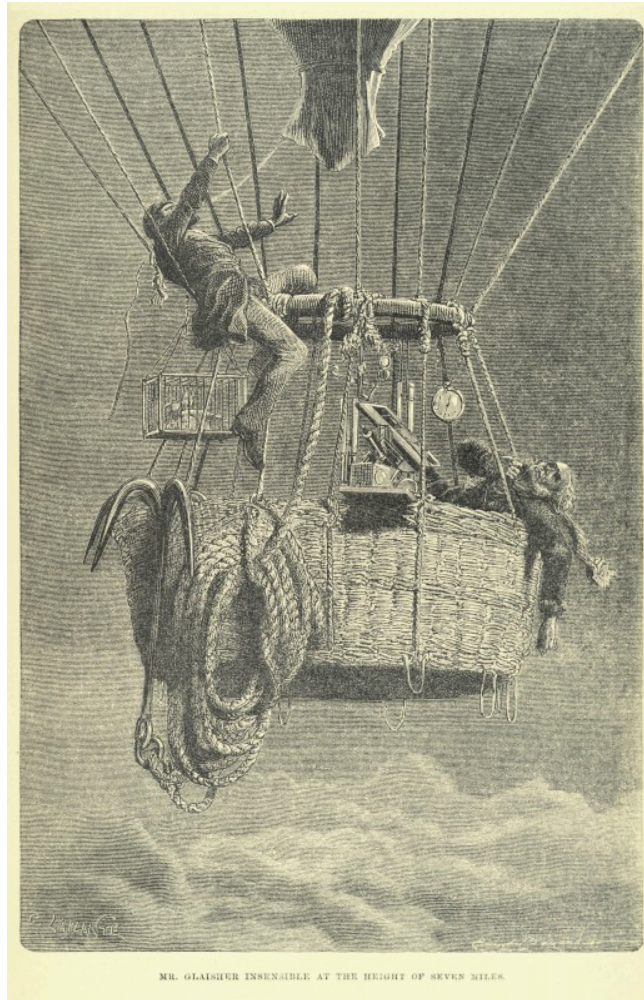




**Figure 21.**

C. Laplante, *Inflation of the Captive Balloon at the Exhibition*, in *Travels in the Air* (London: Richard Bentley & Son, 1871), 253, 1865, woodcut engraving. Collection of the National Library of Scotland. Digital image courtesy of National Library of Scotland (all rights reserved).

Central to the success of the balloon experience—a journey that could be pleasurable, but also frightening and perilous—was how well the aeronaut managed the gas, which was released to descend the balloon. An illustration reproduced in the book *Travels in the Air*, published in 1871, shows James Glaisher’s historic high ascent—where the aeronaut Henry Coxwell (1819–1900) is clinging to the hoop, trying to release the gas valve by using his teeth (his hands were frozen) to pull the rope that opened it and so lower their descent and save their lives (fig. 22). The incident dramatized the general lack of control over the balloon: the “erratic and relatively ungoverned movement of the machine”.<sup>60</sup> Green went on to make hundreds of ascents from Vauxhall Gardens, with spectators from diverse backgrounds paying an admission price to watch. In 1836, he launched from Vauxhall Gardens and landed eighteen hours later and five hundred miles away in Weilburg, in the Duchy of Nassau—a world distance record that held until 1907. The balloon was renamed the *Royal Nassau*, and a new balloon hall, with a specially built hangar to allow for its inflation under cover, opened soon after. Interestingly, as coal gas was not produced in Nassau, the return journey had to be made by carriage.



**Figure 22.**

C. Laplante, Mr Glaisher Insensible at the Height of Seven Miles, in *Travels in the Air* (London: Richard Bentley & Son, 1871), 55, lithograph. Collection of the National Library of Scotland. Digital image courtesy of National Library of Scotland (all rights reserved).

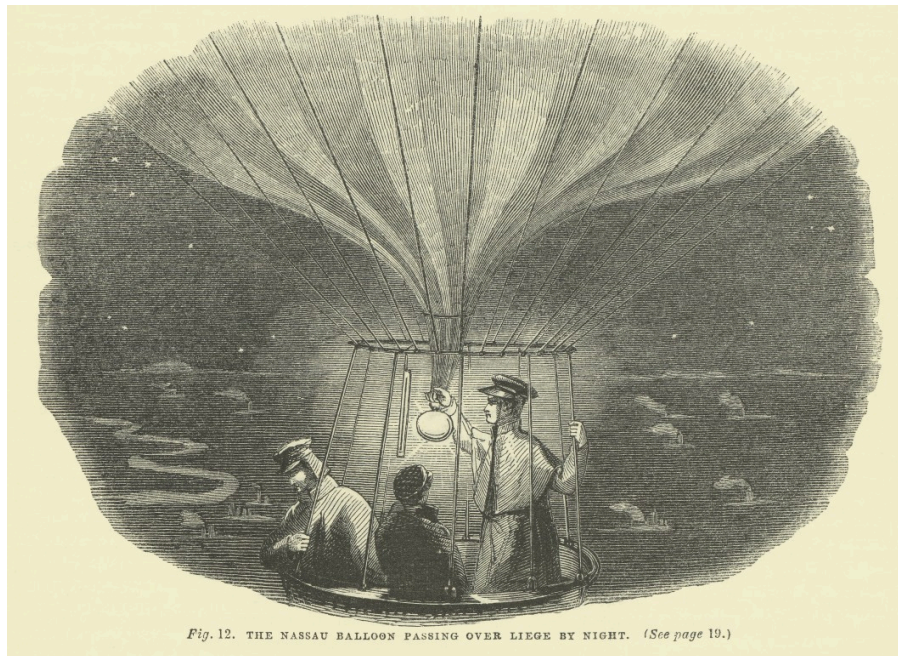
Accounts of Green's adventures are traceable through the scattered records of Victorian popular shows, such as a one-page printed advertisement from 1850 announcing that Green would ascend in a balloon while seated on a horse. In 1852, he ascended with the journalist and social reformer Henry Mayhew, who wrote perhaps the best-remembered narrative of a balloon journey over the Thames. For Mayhew, whose groundbreaking survey of London's working class, *London Labour and the London Poor*, was published as a book in 1851, around the same time as his flight with Green, the balloon offered a point of view that transcended the local perspective, a bird's-eye view that could literally see the city and its interlocking parts. In "In the Clouds', or, Some Account of a Balloon Trip with Mr. Green", published in the *Illustrated London News*, 18 September 1852, Mayhew wrote a vivid account

of the evening voyage, which began in the bright pleasure grounds of Vauxhall Gardens and ended in a Surrey swamp: "I had seen the world of London below the surface, as it were, and I had a craving to contemplate it far above it—to behold the immense mass of vice and avarice and cunning, of noble aspirations and humble heroism, blent into one black spot". And indeed, as the famous *Royal Nassau* balloon rose into the air, the geography of the lives of the costermongers, oyster sellers, flower girls, hawking butchers, and pickpockets whose activities Mayhew recorded in *London Labour and the London Poor* came into undifferentiated view.<sup>61</sup> He acknowledged curiosity about the "histories, habits, natures, and impulses" of the slum-dwellers of Jacob's Island, located on the south bank of the Thames. This area had been popularized by Dickens in *Oliver Twist* (1837–1839), before many dwellings in the area were cleared for new development in the 1860s. But it had initially been "merely idle curiosity"—not sociological zeal—"that took me into the air", Mayhew declared. He confessed to experiencing the "most exquisite delight I ever experienced", peering over the wicker basket above the fields of Surrey. The adventure was not seamless, and he recalled the experience in passages that convey the presence of gas in their imaginative repertoire, as he and friends floated in the air: "Above us reeled the great gas-bag like a monster peg-top, and all around the car were groups of men holding to the sides of the basket". He remarked:

The houses below looked like the tiny wooden things out of a child's box of toys, and the streets like ruts. To peer straight down gave you an awful sense of the height to which the balloon had already risen, and yet there was no idea of danger, for the mind was too much occupied with the grandeur and novelty of the scene all around to feel the least alarm. As the balloon kept on ascending, the lines of buildings grew smaller and smaller, till in a few minutes the projections seemed very much like the prominences on the little coloured plaster models of countries.<sup>62</sup>

It was then, Mayhew exclaimed, that "we could see the gas lights along the different lines of road start into light one after another all over the earth, and presently the ground seemed to be covered with little miniature illumination lamps, such as may be seen resting on the grass at the sides of the gravel walks in suburban gardens of amusement. The river we could see winding far away, undulating, as it streamed along, like a man-of-war's pennant, and glittering here and there in the dusk like grey steel".<sup>63</sup> Furthermore, the bridges across the Thames appeared "almost like planks; while the tiny black barges, as they floated up the river, appeared no bigger than insects".<sup>64</sup>

Balloons mostly carried passengers over metropolitan landscapes, revealing panoramas, and seeing the spread of cities, with their growing populations and new industries: factories, slums, parks, docks, city sights and smells and sounds. Observers who made balloon ascents from Vauxhall and other gas-supplied points along the river created verbal and visual descriptions of the Thames and its rapidly changing environs, observing towns illuminated by gas light and evidence of pollution. Passengers who ascended with Green occasionally left photographic and other visual and documentary records of environmental transformation in places that were far beyond London. After a balloon journey by Green and others over Belgium, an artist depicted the nocturnal scene of smoking chimneys lit up below; the sounds of the factories being the only sounds the passengers heard in their night voyage over the industrial landscape, when the skies were as dark, as one said, as a “mass of black marble” (fig. 23).<sup>65</sup> Such images testify to how the aerial views enabled by gas were also what was required to comprehend the emerging scale of industry itself.



**Figure 23.**

Night Voyage to Nassau: The Nassau Balloon with the Aeronaut Charles Green Passing Over Liege at Night, with Smoking Factories Below, in *Cyclopaedia of Useful Arts, Mechanical and Chemical, Manufactures, Mining, and Engineering*, by Charles Tomlinson, Vol. I (London: James S. Virtue, 1886), Fig. 12, circa 1836, woodcut engraving. Wellcome Collection. Digital image courtesy of Wellcome Collection (public domain).

The coal-gas-filled balloon also enabled new visions of the heavens for observers who could afford to ascend. The French meteorologist and fervent champion of the balloon Camille Flammarion commented in the 1870s on the sounds of the river when he was airborne in a balloon: “The air is the first

bond of society ... the great medium of sound, the liquid channel in which our words travel, the vehicle of language, of ideas, and of social communication".<sup>66</sup> Flammarion once wrote, about the experience of observing the atmosphere from the vantage point of a balloon, that "Such are the last and grandest of the phenomena which we have to contemplate in this gallery of the works of the Atmosphere".<sup>67</sup> Ballooning not only made possible new scientific investigation of the atmosphere, but also spurred a new emotional engagement with the "ocean of air" above our head: "Atmosphere" was—and is—still defined both as an "envelope of gases" surrounding the earth or another planet, and as the "pervading tone or mood of a place, situation, or work of art".<sup>68</sup>

Among the most enduring aerial views of London as seen from a balloon were those of the Thames. On 31 March 1863, on a flight that he made from Crystal Palace one mile high, James Glaisher—in a rare moment when he was not making scientific observations on meteorological phenomena in the upper atmosphere—described the "winding Thames, leading the eye to the white cliffs at Margate and on to Dover" as "sharply defined". "All the docks were mapped out", he continued, "and every object of moderate size was seen with the naked eye". What struck him was the regularity of the scene: "Taking a grand view of the whole visible area beneath, I was struck with its great regularity: all was dwarfed to one plane; it seemed too flat even, even artificial". The "effect of the river scenery in this respect was remarkable", he stated: "the ships, visible even beyond the Medway, looked like toys". He used metallic imagery to describe the river's surface appearance: "Towards Windsor the Thames looked like burnished gold, and the surrounding water like bright silver".<sup>69</sup>

This description of the Thames as "orderly", even "metallic", relates to other ways (social, scientific, industrial) of imagining and understanding the city. It looks forward to artist Maya Lin's wall work, *Silver Thames*, representing an aerial view of the waterway, in which the image of the Thames is made of either recycled silver or steel pins, with the wall forming the surrounding land, enabling viewers to see this, and other, rivers both as interconnected wholes and as dynamic, sculptural forms (fig. 24).<sup>70</sup> The industrial riverscape also points to the important role the river played in the economic and cultural identity of Britain. In thinking about the integration of technology into history and physical landscapes, a useful concept is that of "throughlines", as discussed by photographer Richard Misrach and landscape architect Kate Orff in their book *Petrochemical America*. In their collaboration to engage histories of the chemical corridor in Louisiana, an area of heavy chemical industry since the late nineteenth century, they made and responded to photographs of industry that built on, and among, living communities with their own histories—and the co-relations of humans,

industry, and animals. As Misrach put it, “We started to think about this very simple photograph in many different dimensions—going back in time and understanding that this was a former indigo plantation that then became sugarcane, and although it was empty today was once teeming with slave labor and then with plantation workers”.<sup>71</sup> Their goal as artists—and ours as social and cultural historians—is to reveal the complexity of environmental systems and stories embedded in the landscape. Orff calls this approach searching for “throughlines” into “stories about zones around the world that are now going through the same cycle of extraction-based industry, waste, displacement, and resistance, whether in the Nigerian Delta, or the rice fields and fishing grounds of Myanmar”. Industrialization, on this reading, resulted not simply from technological changes, but rather from a series of political defeats that led to the consolidation of capitalist and colonial modernities.



**Figure 24.**

Maya Lin, *Silver Thames*, 2012, recycled silver, cast 1 of 3, edition of 3 (2 APs), 48.26 × 198 × 1 cm. Collection of The Alford Collection of Contemporary Art at Rollins College Cornell Fine Arts Museum (2013.34.088). Digital image courtesy of Maya Lin Studio, courtesy Pace Gallery (all rights reserved).

## Coal-Gas London

Though colorless, coal gas was most certainly a visible presence in the riverscape. Prominent features of the skyline in nineteenth-century London, including the dome of St. Paul’s Cathedral, the Parliament building, and Tower Bridge, continue to be visually notable in London today. Some of the largest structures of that skyline, however, are no longer present or survive

only as skeletal frames. These landmarks were the gasholders of the manufactured gas industry, built to store a day's supply of gas for an increasingly "light-hungry" metropolis.<sup>72</sup> The establishment of gasworks materially recast the bank of the river and affected the placement of the observer in relation to the city and its surrounding landscapes. It evolved the river into a conduit for both modern entertainment and deadly risk. Consideration of the visual gas field shows that these "involuntary neighbors" of the nineteenth-century Thames were not only connected by its waters, but also by a form of energy that bridged earth, air, and water, with far-ranging impacts on the river's ecology, the people who lived and worked on it, and the ways in which the river was seen and imagined.

## Footnotes

- 1 H.G. Wells, *The Invisible Man* (London: C. Arthur Pearson, 1897), ch. 19. See also Nathaniel Otjen, "Energy Anxiety and Fossil Fuel Modernity in H.G. Wells's *The War of the Worlds*", *Journal of Modern Literature* 43, no. 2 (Winter 2020): 118-133.
- 2 On the manufacture of gas along the Thames, see esp. Leslie Tomory, "Building the First Gas Network, 1812-1820", *Technology and Culture* 52, no. 1 (Jan. 2011): 75-102; Tomory, "Gaslight, Distillation, and the Industrial Revolution", *History of Science* 49, no. 4 (2011): 395-424. On the connection of water quality and the Thames in the eighteenth century, see Tomory, "The Question of Water Quality and London's New River in the Eighteenth Century", *Social History of Medicine* 27, no. 3 (2014): 488-507. Gasworks produced coke by heating coal in enclosed chambers. The flammable gas that was given off was stored in gasholders, to be used domestically and industrially. The gas was commonly known as "town gas" since underground networks of pipes ran through most towns. It was replaced by "natural gas" (initially from the North Sea oil and gas fields) in the decade after 1967. Other by-products of coke production included tar and ammonia, which were important chemical feedstock for the dye and chemical industries, with a wide range of artificial dyes being made from coal gas and coal tar.
- 3 Leslie Tomory, *Progressive Enlightenment: The Origins of the Gaslight Industry, 1780-1820*, Cambridge, MA: MIT Press, 2012, 1.
- 4 Although the gas industry was among the first of a new wave of technologies of the Industrial Revolution, its origins and effects on art, environment, and urban life have been much less studied than those of other industries such as textiles, coal mining, and railways. The implications for art and visual culture of the close links between coal gas manufacturing and ballooning have been relatively unmarked. Important exceptions include Lynda Nead, *Victorian Babylon* (New Haven: Yale University Press, 2000), and Nicholas Robbins, "Oceans of Air: Lands and Climate in the Nineteenth-Century Atlantic, 1774-1784" (PhD diss., Yale University, 2019).
- 5 On nineteenth-century art and industry generally, see Nead, *Victorian Babylon*; Kate Nichols, Rebecca Wade, and Gabriel Williams, eds. *Art versus Industry? New Perspectives on Visual and Industrial Cultures in Nineteenth-Century Britain* (Manchester: Manchester University Press, 2016); and Francis D. Klingender, *Art and the Industrial Revolution* (New York: Augustus M. Kelley, 1968), among others, including authors in this volume. See also Peter Thorsheim, *Inventing Pollution: Coal, Smoke and Culture in Britain since 1800* (Ohio University Press, 2018); and Jennifer Tucker, "Dangerous Exposures: Work and Waste in the Victorian Chemical Trade", *International Labor and Working-Class History* 95 (July 2019): 130-165.
- 6 Michelle Murphy, *Sick Building Syndrome and the Problem of Uncertainty: Environmental Politics, Technoscience, and Women Workers* (Durham, NC: Duke University Press, 2006).
- 7 Rob Nixon, *Slow Violence and the Environmentalism of the Poor* (Cambridge, MA: Harvard University Press, 2011).
- 8 See Thomas Newbigging, *The Gas Manager's Handbook; Consisting of Tables, Rules, and Useful Information for Gas Engineers, Managers, and Others Engaged in the Manufacture and Distribution of Coal Gas* (London: W.B. King, 1874), esp. 159-164.
- 9 In France some argued that the country should conserve its coal stocks for producing steam and iron (rather than distilling it for gas light).
- 10 Jean-Baptiste Fressoz, "The Gas Lighting Controversy: Technological Risk, Expertise, and Regulation in Nineteenth-Century Paris and London", *Journal of Urban History* 33, no. 5 (2007): 734.
- 11 James Glaisher, ed., *Travels in the Air* (London: Richard Bentley, 1871).
- 12 Barbara Stafford, *Voyage into Substance* (Cambridge, MA: MIT Press, 1984); Jennifer Tucker, "Voyages of Discovery on Oceans of Air: The Image of Science in an Age of 'Balloonyacy'", *Osiris* 11: *Science in the Field* (1996): 144-176; Jonathan Potter, *Discourses of Vision in Nineteenth-Century Britain* (London: Palgrave Macmillan, 2018), esp. 47-68; Robbins, "Oceans of Air".

- 13 The gas-light industry along the River Thames began in the 1810s, but the Thames-based gas industry dates back much further. Rich records and traces of its origins extend our historical knowledge of the technological, ecological, sociocultural, and visual histories of gas.
- 14 Doctoral student Johana Godfrey (English Department, Northwestern University) discusses the excavation of the Thames riverbank by working-class antiquaries as being central to the “sedimented spaces” and nonsequential narratives in Charles Dickens’s later fiction, including *Our Mutual Friend*, in “Sedimented Space, Nonsequential Narratives, and Working-Class Antiquaries in Dickens’s Later Fiction” (paper presented at the Interdisciplinary Nineteenth-Century Studies conference (“Nineteenth-Century Strata”), Salt Lake City, Utah, 27 March 2022).
- 15 Janet Thomson, *The Scot Who Lit the World: The Story of William Murdoch, Inventor of Gas Light* (Eastbourne: Gardners Books, 2003).
- 16 Trevor I. Williams, *A History of the British Gas Industry* (Oxford: Oxford University Press, 1981), 4–9.
- 17 Stirling Everard, *The History of the Gas Light and Coke Company, 1812–1949* (London: Ernest Benn Ltd., 1949), 15–20, 56–74.
- 18 Maps in Everard, *The History of the Gas Light and Coke Company*.
- 19 Tomory, “Gaslight, Distillation, and the Industrial Revolution”.
- 20 Everard, *The History of the Gas Light and Coke Company*, 33.
- 21 Source: Musée Carnavalet, Estampes; reproduced in Fresso, “The Gas Lighting Controversy”, 735.
- 22 Everard, *The History of the Gas Light and Coke Company*, 49.
- 23 Vanessa Taylor, “Watershed Democracy or Ecological Hinterland? London and the Thames River Basin, 1857–1989”, in *Rivers Lost, Rivers Regained: Re-thinking City-River Relations*, ed. Martin Knoll, Uwe Lübken, and Dieter Schott (Pittsburgh: University of Pittsburgh Press, 2017), 63–81. There is a broad global literature on rivers and the environment. See, for example, Christopher F. Jones, *Routes of Power: Energy and Modern America* (Cambridge, MA: Harvard University Press, 2014); and Shellen Xiao Wu, *Empires of Coal: Fueling China’s Entry into the Modern World Order, 1860–1920* (Stanford: Stanford University Press, 2015).
- 24 Everard, *The History of the Gas Light and Coke Company*; Williams, *A History of the British Gas Industry*.
- 25 Discussed in Klingender, *Art and the Industrial Revolution*, 126. The print was conserved in a collection of prints and books documenting the early history of the gas industry, amassed by Sir Arthur Elton, a pioneer of the British scientific documentary film industry.
- 26 He further noted that it was around this time that “for the first time in their long history an artist selected coal-mines as a subject for systematic study”, selecting Thomas H. Hair’s *Sketches of the Coal Mines in Northumberland & Durham*, a volume of etching after his own drawings. Klingender, *Art and the Industrial Revolution*, 126–127.
- 27 Thomas B. Simpson, *Gas-Works: The Evil: The Evil Inseparable from Their Existence in Populous Places, and the Necessity for Removing Them from the Metropolis, as has been done in Paris* (London: Freeman, 1866).
- 28 Simpson, *Gas-Works*, 8.
- 29 Simpson, *Gas-Works*, 11.
- 30 Simpson, *Gas-Works*, 11.
- 31 *Morning Herald*, 2 November 1865, quoted in Simpson, *Gas-Works*, 17–18. These remarks, and Simpson’s book, followed the fatal gas explosion at the London Gas Light Company works at Nine Elms on 31 October 1865. The site had two gasholders, each holding about a million cubic feet of gas. One of these exploded and was completely destroyed; the other caught fire but did not explode. Seven men were killed at the scene, and many more were injured.
- 32 Simpson, *Gas-Works*, 21.
- 33 Simpson, *Gas-Works*, 21–22.
- 34 Emily Irwin, “The Spermaceti Candle and the American Whaling Industry”, *Historia* 21 (2012): 45–53; Stephen Croad, *Liquid History: The Thames Through Time* (London: Batsford, 2003); Gavin Weightman, *London’s Thames: The River That Shaped a City and Its History* (New York: St. Martin’s Press, 2005); Alwyn Wheeler, *Tidal Thames: History of a River and Its Fishes* (New York: Routledge, 1979).
- 35 For archival records see, among others, the Institution of Gas Engineers & Managers, now located in Kegworth, Derbyshire. Leslie Tomory and other historians have made close examination of newspapers, legal records, and unpublished archives from court cases from the period, brought by Thames fisheries against the emerging gas companies. Further light is needed on how industrial pollution of the Thames was regarded in the law, revealing how local authorities moved against gas pollution, however ineffectively. This also will deepen our understanding of the colorful visual language invented to describe “gas-impregnated” oily waters in legal, scientific, and popular culture.
- 36 Fresso, “The Gas Lighting Controversy”, 747.
- 37 Minutes of the Court of Conservancy (MCC), LMA Document CLA/036/01/008, Session for Surry [sic], 8 September 1821. Discussed in Leslie Tomory, “Environmental History of the Early British Gas Industry”, *Environmental History* 17, no. 1 (2012): 41.
- 38 Tomory, “Environmental History of the Early British Gas Industry”, 42–43.
- 39 Tomory, “Environmental History of the Early British Gas Industry”, 43.
- 40 Tomory, “Environmental History of the Early British Gas Industry”, 44.



- 41 Accidents discussed in Fressoz, "The Gas Lighting Controversy", and by others.
- 42 British Parliamentary Papers, 1823, 7, 13, 32. Discussed in Fressoz, "The Gas Lighting Controversy", 733–735.
- 43 Discussed in Fressoz, "The Gas Lighting Controversy", 744. ("Gas agitation" was Simpson's phrase, in *Gas-Works*.)
- 44 Johann Hecke, *Reise durch die Vereinigten Staaten von Nord-Amerika in den Jahren 1818 und 1819, und Rückreise durch England*, Vol. 2 (Berlin: Petri, 1820–1821), 286.
- 45 On new ways of seeing and the effects on nineteenth-century art and visual culture see, among others: Jonathan Potter, *Discourses of Vision in Nineteenth-Century Britain: Seeing, Thinking, Writing* (London: Palgrave Macmillan, 2018); Vanessa R. Schwartz, *Spectacular Realities: Early Mass Culture in Fin-de-Siècle Paris* (Berkeley: University of California Press, 1999); Nead, *Victorian Babylon*; and Richard D. Altick, *The Shows of London* (Cambridge, MA: Harvard University Press, 1978).
- 46 Warwick Wroth, *The London Pleasure Gardens of the Eighteenth Century* (London: Macmillan, 1896), 1.
- 47 Wroth, *The London Pleasure Gardens*, 286–326, 287.
- 48 Tucker, "Voyages of Discovery on Oceans of Air". Robbins, "Oceans of Air".
- 49 Potter, *Discourses of Vision in Nineteenth-Century Britain*, 47, 51. Panoramic descriptions of balloon views were common, and by 1858 a patent for aerial photography had been filed by the French photographer Nadar (Gaspard-Félix Tournachon), the best-known aerial photographer of the nineteenth century. See Adam Begley, *The Great Nadar: The Man Behind the Camera* (New York: Penguin Books, 2017). For a detailed description of the relationship between balloons and aerial photography, see Denis Cosgrove and William L. Fox, *Exposures: Photography and Flight* (London: Reaktion Books, 2010), 23–51.
- 50 Helen Wickstead and Martyn Barber, "'One Immense Black Spot': Aerial Views of London, 1784–1918", *London Journal* 35, no. 3 (November 2010): 241.
- 51 Barber and Wickstead, "'One Immense Black Spot'", 236.
- 52 Barber and Wickstead, "'One Immense Black Spot'", 244.
- 53 Patrick Ellis, "The Panstereorama: City Models in the Balloon Era", *Imago Mundi* 70, no. 1 (2018): 79–93. Martyn Barber reproduced a remarkable photograph of Parliament and the Thames taken from the balloon *Corona* on 22 May 1909 in his book *A History of Aerial Photography* (Swindon: English Heritage, 2011), fig. 3.29 (The book includes a chapter about Victorian and Edwardian balloons.)
- 54 Jonathan Crary, *Techniques of the Observer: On Vision and Modernity in the 19th Century* (Cambridge, MA: MIT Press, 1990).
- 55 Henry Cavendish, "Experiments on Air. By Henry Cavendish, Esq. F.R.S. & S.A.", *Philosophical Transactions of the Royal Society of London* 74 (1784): 119–153, <http://www.jstor.org/stable/106582>; David Phillip Miller, *Discovering Water: James Watt, Henry Cavendish and the Nineteenth-Century "Water Controversy"* (New York: Routledge, 2017).
- 56 See Christopher Hatton Turnor, *Astra Castra: Experiments and Adventures in the Atmosphere* (London: Chapman & Hall, 1865).
- 57 Discussed in Turnor, *Astra Castra*; Glaisher, *Travels in the Air*. On Victorian aeronauts, see L.T.C. Rolt, *The Aeronauts, 1783–1903* (London: Walker & Co., 1966), and Patrick De Oliveira, "The Ascending Republic: Aeronautical Culture in France, 1860–1914" (PhD diss., Princeton, 2017).
- 58 Glaisher, *Travels in the Air*, 78.
- 59 At the same time, they also point to the material source of this gas—coal—as another way of thinking about the ramifications for nineteenth-century society and the environment, and on the many ways that coal was transformed into energy, lighting, pollution, labor, entertainment, and mobility.
- 60 Glaisher, *Travels in the Air*, 21; Tucker, "Voyages of Discovery on Oceans of Air".
- 61 Henry Mayhew, "'In the Clouds', or, Some Account of a Balloon Trip with Mr. Green", *Illustrated London News*, 18 September 1852, 224.
- 62 Mayhew, "In the Clouds".
- 63 Mayhew, "In the Clouds".
- 64 Mayhew, "In the Clouds".
- 65 Camille Flammarion, quoted in Glaisher, *Travels in the Air*, 207.
- 66 Camille Flammarion, *The Atmosphere* (New York: Harper and Bros., 1873), 23.
- 67 Flammarion, *The Atmosphere*, 453.
- 68 *Oxford English Dictionary Online*, s.v. "atmosphere (n.)", accessed 28 March 2022, <https://www.oed-com.ezproxy.wesleyan.edu/view/Entry/12552?rkey=fa4zXQ&result=1>.
- 69 Glaisher, *Travels in the Air*, 79.
- 70 Shalini Le Gall discusses this work in "Framing Environment in an Exhibition of Whistler's 'Thames Set'", in *Artful Encounters: Sites of Visual Inquiry*, ed. Christina Smylitopoulos (Guelph, ON: Bachinski/Chu Print Study Collection, School of Fine Art and Music, University of Guelph, 2021), 53–74].

- 71 Richard Misrach and Kate Orff, *Petrochemical America* (New York: Aperture, 2014). They discuss the “complex web of industrial and ecological and human stories” that give rise to images. “Richard Misrach and Kate Orff Discuss Petrochemical America” (interview by Melissa Harris, 17 September 2021) may be accessed at *Aperture*. <http://aperture.org/blog/richard-misrach-and-kate-orff-in-conversation/2/>.
- 72 Tomory, “The Environmental History of the Early British Gas Industry”, 1; Chris Otter, *The Victorian Eye: A Political History of Light and Vision in Britain 1800–1910* (Chicago: University of Chicago Press, 2008); Hollis Clayson, *Illuminated Paris: Essays on Art and Lighting in the Belle Époque* (Chicago: University of Chicago Press, 2019); Nead, *Victorian Babylon*; Everard, *The History of the Gas Light and Coke Company*. Coal was transformed into energy, lighting, pollution, and mobility by its modifications in gas manufacture. Early attempts to regulate pollution from gasworks were coincident with attempts to regulate air pollution in London and elsewhere (1820–1821). See Peter Thorsheim, *Inventing Pollution: Coal, Smoke and Culture in Britain since 1800* (Athens, OH: Ohio University Press, 2018); Ben Pontin, “Integrated Pollution Control in Victorian Britain: Rethinking Progress in the History of Environmental Law”, *Journal of Environmental Law* 19, no. 2 (2007): 173–199; and Adam Markham, *A Brief History of Pollution* (London: Earthscan, 1994), which notes fourteenth-century statutes touching on air pollution in England from the burning of coal.

## Bibliography

- Altick, Richard D. *The Shows of London*. Cambridge, MA: Harvard University Press, 1978.
- Aperture*. “Richard Misrach and Kate Orff Discuss Petrochemical America”. Interview by Melissa Harris, 17 September 2012. <http://aperture.org/blog/richard-misrach-and-kate-orff-in-conversation/2/>
- Barber, Martyn. *A History of Aerial Photography*. Swindon: English Heritage, 2011.
- Begley, Adam. *The Great Nadar: The Man Behind the Camera*. New York: Penguin Books, 2017.
- Cavendish, Henry. “Experiments on Air”. By Henry Cavendish, Esq. F.R.S. & S.A.”. *Philosophical Transactions of the Royal Society of London* 74 (17): 119–153. <http://www.jstor.org/stable/106582>.
- Clayson, Hollis. *Illuminated Paris: Essays on Art and Lighting in the Belle Époque*. Chicago: University of Chicago Press, 2019.
- Cosgrove, Denis, and William L. Fox. *Exposures: Photography and Flight*. London: Reaktion Books, 2010.
- Crary, Jonathan. *Techniques of the Observer: On Vision and Modernity in the 19th Century*. Cambridge, MA: MIT Press, 1990.
- Croad, Stephen. *Liquid History: The Thames Through Time*. London: Batsford, 2003.
- De Oliveira, Patrick. “The Ascending Republic: Aeronautical Culture in France, 1860–1914”. PhD diss., Princeton, 2017.
- Ellis, Patrick. “The Panstereorama: City Models in the Balloon Era”. *Imago Mundi* 70, no. 1 (2018): 79–93.
- Everard, Stirling. *The History of the Gas Light and Coke Company, 1812–1949*. London: Ernest Benn Ltd., 1949.
- Flammarion, Camille. *The Atmosphere*. New York: Harper and Bros., 1873.
- Fressoz, Jean-Baptiste. “The Gas Lighting Controversy: Technological Risk, Expertise, and Regulation in Nineteenth-Century Paris and London”, *Journal of Urban History* 33 (2007): 729–755.
- Glaisher, James, ed. *Travels in the Air*. London: Richard Bentley, 1871.
- Godfrey, Johana. “Sedimented Space, Nonsequential Narratives, and Working-Class Antiquaries in Dickens’s Later Fiction”. Paper presented at the Interdisciplinary Nineteenth-Century Studies conference (“Nineteenth-Century Strata”), Salt Lake City, Utah, 27 March 2022.
- Hecke, Johann Valentin. *Reise durch die Vereinigten Staaten von Nord-Amerika in den Jahren 1818 und 1819, und Rückreise durch England*, Vol. 2. Berlin: Petri, 1820–1821.
- Irwin, Emily. “The Spermaceti Candle and the American Whaling Industry”, *Historia* 21 (2012): 45–53.
- Jones, Christopher F. *Routes of Power: Energy and Modern America*. Cambridge, MA: Harvard University Press, 2014.
- Klingender, Francis D. *Art and the Industrial Revolution*. New York: Augustus M. Kelley, 1968.
- Le Gall, Shalini. “Framing Environment in an Exhibition of Whistler’s ‘Thames Set’”. In *Artful Encounters: Sites of Visual Inquiry*, edited by Christina Smylitopoulos, Guelph, 53–74. ON: Bachinski/Chu Print Study Collection, University of Guelph, 2021.
- Markham, Adam. *A Brief History of Pollution*. London: Earthscan, 1994.
- Mayhew, Henry. “‘In the Clouds’, or, Some Account of a Balloon Trip with Mr. Green”. *Illustrated London News*, 18 September 1852, 224.
- Miller, David Phillip. *Discovering Water: James Watt, Henry Cavendish and the Nineteenth-Century ‘Water Controversy’*. New York: Routledge, 2017.
- Misrach, Richard, and Kate Orff, *Petrochemical America*. New York: Aperture, 2014.
- Murphy, Michelle. *Sick Building Syndrome and the Problem of Uncertainty: Environmental Politics, Technoscience, and Women Workers*. Durham, NC: Duke University Press, 2006.
- Nead, Lynda. *Victorian Babylon: People, Streets and Images*. New Haven: Yale University Press, 2000.
- Newbigging, Thomas. *The Gas Manager’s Handbook; Consisting of Tables, Rules, and Useful Information for Gas Engineers, Managers, and Others Engaged in the Manufacture and Distribution of Coal Gas*. London: W.B. King, 1874.
- Nichols, Kate, Rebecca Wade, and Gabriel Williams, eds. *Art versus Industry? New Perspectives on Visual and Industrial Cultures in Nineteenth-Century Britain*. Manchester: Manchester University Press, 2016.

Nixon, Rob. *Slow Violence and the Environmentalism of the Poor*. Cambridge, MA: Harvard University Press, 2011.

Otjen, Nathaniel. "Energy Anxiety and Fossil Fuel Modernity in H.G. Wells's 'The War of the Worlds'". *Journal of Modern Literature* 43, no. 2 (Winter 2020): 118-133.

Otter, Chris. *The Victorian Eye: A Political History of Light and Vision in Britain 1800-1910*. Chicago: University of Chicago Press, 2008.

Pontin, Ben. "Integrated Pollution Control in Victorian Britain: Rethinking Progress in the History of Environmental Law". *Journal of Environmental Law* 19, no. 2 (2007): 173-199.

Potter, Jonathan. *Discourses of Vision in Nineteenth-Century Britain: Seeing, Thinking, Writing*. London: Palgrave Macmillan, 2018.

Robbins, Nicholas. "Oceans of Air: Lands and Climate in the Nineteenth-Century Atlantic, 1774-1784". PhD diss., Yale University, 2019.

Rolt, L.T.C. *The Aeronauts, 1783-1903*. London: Walker & Co., 1966.

Schwartz, Vanessa R. *Spectacular Realities: Early Mass Culture in Fin-de-Siècle Paris*. Berkeley: University of California Press, 1999.

Simpson, Thomas B. *Gas-Works: The Evil Inseparable from Their Existence in Populous Places, and the Necessity for Removing Them from the Metropolis, as has been done in Paris*. London: Freeman, 1866.

Stafford, Barbara. *Voyage into Substance: Art, Science, Nature, and the Illustrated Travel Account*. Cambridge, MA: MIT Press, 1984.

Taylor, Vanessa. "Watershed Democracy or Ecological Hinterland? London and the Thames River Basin, 1857-1989". In *Rivers Lost, Rivers Regained: Re-thinking City-River Relations*, edited by Martin Knoll, Uwe Lübken, and Dieter Schott, 63-81. Pittsburgh: University of Pittsburgh Press, 2017.

Thomson, Janet. *The Scot Who Lit the World: The Story of William Murdoch, Inventor of Gas Lighting*. Eastbourne: Gardners Books, 2003.

Thorsheim, Peter. *Inventing Pollution: Coal, Smoke and Culture in Britain since 1800*. Athens, OH: Ohio University Press, 2018.

Tomory, Leslie. "Building the First Gas Network, 1812-1820". *Technology and Culture* 52, no. 1 (January 2011): 75-102.

Tomory, Leslie. "Gaslight, Distillation, and the Industrial Revolution". *History of Science* 49, no. 4 (2011): 395-424.

Tomory, Leslie. "Environmental History of the Early British Gas Industry". *Environmental History* 17, no. 1 (2012): 41.

Tomory, Leslie. *Progressive Enlightenment: The Origins of the Gaslight Industry, 1780-1820*. Cambridge, MA: MIT Press, 2012.

Tomory, Leslie. "The Question of Water Quality and London's New River in the Eighteenth Century". *Social History of Medicine* 27, no. 3 (2014): 488-507.

Tucker, Jennifer. "Dangerous Exposures: Work and Waste in the Victorian Chemical Trade". *International Labor and Working-Class History* 95 (July 2019): 130-165.

Tucker, Jennifer. "Voyages of Discovery on Oceans of Air: The Image of Science in an Age of 'Balloony'". *Osiris* 11: *Science in the Field* (1996): 144-176.

Turnor, Christopher Hatton. *Astra Castra: Experiments and Adventures in the Atmosphere*. London: Chapman and Hall, 1865.

Weightman, Gavin. *London's Thames: The River That Shaped a City and Its History*. New York: St. Martin's Press, 2005.

Wells, H.G. *The Invisible Man*. London: C. Arthur Pearson, 1897.

Wheeler, Alwyn. *Tidal Thames: History of a River and Its Fishes*. New York: Routledge, 1979.

Wickstead, Helen, and Martyn Barber. "'One Immense Black Spot': Aerial Views of London, 1784-1918". *London Journal* 35, no. 3 (November 2010): 236-254.

Williams, Trevor I., *A History of the British Gas Industry*. Oxford: Oxford University Press, 1981.

Wroth, Warwick. *The London Pleasure Gardens of the Eighteenth Century*. London: Macmillan, 1896.

Wu, Shellen Xaio. *Empires of Coal: Fueling China's Entry into the Modern World Order, 1860-1920*. Stanford: Stanford University Press, 2015.

# Licensing

The Publishers of *British Art Studies* are committed to supporting scholarship on British art and architecture of all periods. This publication is made available free of charge at <https://www.britishartstudies.ac.uk>. We ask users to identify the use of materials made available through this website and to provide an appropriate credit to the author and the publication, so that others may find and use our resources.

Except where otherwise noted, this work is licensed under a Creative Commons Attribution-NonCommercial 2.0 UK: England & Wales Licence (CC BY-NC 2.0 UK). To view a copy of this license, visit <https://creativecommons.org/licenses/by-nc/2.0/uk/> or send a letter to Creative Commons, PO Box 1866, Mountain View, CA 94042, USA.

The Publishers fully support the protection of intellectual property and are committed to complying with, and strictly adhering to, all applicable copyright law. In many cases, copyright or other proprietary rights may be held by individuals or entities other than, or in addition to, the Publishers. If a work or a photographic image is still protected by copyright, you must cite the relevant copyright information when using the image and comply with all other terms or restrictions that may be applicable to that material.

In some cases, exceptions to copyright that permit limited use of protected works without the permission of the copyright owner may have been applied. We are confident that we have carried out due diligence in our use of copyrighted material as required, but we apologise for any inadvertent infringement of rights.

Digital copies of resources are made accessible for research for one of the following reasons:

- they are in the public domain;
- the rights are owned by the Publishers;
- we make them accessible under an exception or limitation to UK copyright law, as outlined in the Copyright, Designs and Patents Act 1988 (as amended);
- we have permission to make them accessible;
- or, there are no known restrictions on use.

If you believe that we have made a mistake and wish for your material to be removed from our site, please contact us at [copyright@paul-mellon-centre.ac.uk](mailto:copyright@paul-mellon-centre.ac.uk).

Please include the following information with your request:

- Name and contact information, including email address and phone number.
- Identification of the resource for consideration of removal. Providing URLs in your communication will help us locate content quickly.
- The reason for the request.

The Publishers respond promptly, normally within 21 business days. We may remove the resource from our site while we assess the validity of the request. Upon completion of the assessment, we will take appropriate action and communicate that action to you.