Book:
Gillin, EJ orcid.org/0000-0001-9449-9292 (2017) The Victorian Palace of Science: Scientific Knowledge and the Building of the Houses of Parliament. Science in History . Cambridge University Press , Cambridge . ISBN 9781108419666

https://doi.org/10.1017/9781108303873

4. Chemistry in the Commons: Edinburgh science and David Boswell Reid's ventilating of Parliament, 1834-1854

Then the Lord God formed man of dust from the ground,

And breathed into his nostils the breath of life;

Genesis 2:7

As Charles Barry's new Houses of Parliament took shape on the banks of the River Thames, the business of government continued in Robert Smirke's temporary accommodation. Surrounded by the building site which would one day provide a permanent residence, the Lords in the old Painted Chamber and the Commons in the old House of Lords, governed the nation. The novelty of this arrangement wore off and the new premises were soon judged inadequate. The Painted Chamber was too small to satisfy the dignity of the Lords and aroused continual complaint, while the problem of ventilation was a source of much discontent.[509] The old House of Commons had incurred criticism over the quality of air, yet the new location provoked increased concern from members. In the summer heat of 1835 conditions in the temporary Parliament became intolerable. To resolve these difficulties a select committee, established to investigate the quality of air in Parliament, appointed David Boswell Reid (1805-1863), a Scottish chemist, to construct a powerful system of ventilation in the Commons. Details of Reid's work in Edinburgh built credibility into claims that he could improve Parliament's air. He promised to perform experiments in the Commons to guide the construction of this system. Between 1835 and 1840 his work ensured the Commons was not only a place of political debate, but a site of chemical experiment and knowledge production.

This chapter explores the choice of Reid as a trustworthy authority to perform experiments at Westminster, but it is also about the difficulties of performing science in different locations. Reid asserted that his work, including ventilation, was chemistry and that the practices which guided the form it took were experiments. Such experiments consisted of finding ways to determine the chemical composition of air in buildings, before and after human respiration. To ventilate a room thus involved controlling the

[509] M. H. Port, 'The New Houses of Parliament', in J. Mordaunt Crook and M. H. Port (eds.), *The History of the King's Works*, Vol. VI: 1782-1851, (London, 1973), pp. 573-626, 575.

chemical composition of this air and keeping it free of what were deemed to be dangerous elements, like carbonic acid. During the nineteenth century, architects and engineers strove to assert control over the interior atmospheres of hospitals, theatres, and prisons. Ventilation was subject to several extended studies, most notably Thomas Tredgold's 1824 *Principles of warming and ventilating public buildings*.[510] The conviction that stagnant air conveyed mysterious agents of disease sustained these efforts. It is telling that in 1830s' British political culture, the same debating chamber in-which legislation was constructed and scrutinized, was deemed an appropriate place for the production of experimental knowledge. Henrik Schoenefeldt's detailed architectural analysis has astutely drawn attention to the role of experiment in the construction of Reid's ventilation system. Schoenefeldt correctly asserts that Reid promoted a distinct approach to architecture, prioritizing attention to air supply and the health of a building's inhabitants.[511] Furthermore, he shows how Reid transformed the temporary Commons into a place of experiment, effectively reconceiving the building as a laboratory. Yet Reid's efforts at Westminster were also important in a broader epistemological context, where the question of how to make science, and what constituted a valid experiment were not givens.

As will be shown, the construction of credibility was central to the problem of ventilating Parliament, and credibility was not inherent to experimental practices, but contingent on local cultural contexts.[512] As Ben Marsden and Crosbie Smith put it, the success of a technology involves its social, as

---

[510] Robert Bruegmann, 'Central Heating and Forced Ventilation: origins and effects on architectural design', *Journal of the Society of Architectural Historians*, Vol. 37, No. 3 (Oct., 1978), pp. 143-60, 149-52; see Thomas Tredgold, *Principles of warming and ventilating public buildings, dwelling-houses, manufactories, hospitals, hot-houses, conservatories, & c.*, (London, 1824); also see Neil Sturrock and Peter Lawson-Smith, 'The Grandfather of Air-Conditioning: the work and influence of David Boswell Reid, physician, chemist, engineer (1805-63)', *Proceedings of the Second International Congress on Construction History*, 3, (2006), pp. 2981-98, 2981; Reyner Banham, *The Architecture of the Well-Tempered Environment*, (London, 1969), pp. 11 and 29; John Hix, *The Glass House*, (London, 1974).

[511] Henrik Schoenefeldt, 'The temporary Houses of Parliament and David Boswell Reid's architecture of experimentation', *Architectural History*, 57 (2014), pp. 173-213, 173; compare with Henrik Schoenefeldt, 'The Crystal Palace, environmentally considered', *Architectural Research Quarterly*, Vol. 12, Issue 3-4 (Dec., 2008), pp. 283-94. Schoenefeldt's work places Reid's ventilation schemes within a broader history of design, and is certainly not an attempt to 'rehabilitate his scientific theories', as has been suggested in Caroline Shenton, *Mr Barry's War: rebuilding the Houses of Parliament after the great fire of 1834*, (Oxford University Press: Oxford, 2016), p. 166.

[512] Steven Shapin, *Never Pure: historical studies of science as if it was produced by people with bodies, situated in time, space, culture, and society, and struggling for credibility and authority*, (Baltimore, 2010), p. 19.

well as material worth. The way a technology is displayed and marketed raises questions over the trustworthiness of its human promoters. The plausibility of a scheme, or its credibility, has to be built through trusting human actors. In turn an actor's trustworthiness has to be manufactured through their behaviour, such as conducting experiments in an appropriate manner or presenting findings in a way acceptable to society.[513] The credibility of an apparatus, theory, or experiment, was shaped by trust, which in turn was secured by the actions and values of the promoter. Individual character was crucial to being believed. The question then is how did Reid, an Edinburgh chemist, become trusted to experiment in the Commons?[514]

The production of knowledge through experiment took place in physical and social settings which inscribed meaning on what Reid constructed. Local contexts shaped why experiments were performed, who witnessed them, how the results were interpreted, and to what purpose knowledge was applied. Where science was produced was important to how and why it was produced.[515] My argument is not that an environment determined the formation of science, but that local contexts, including networks of human agents, shaped the character and meaning of a body of knowledge. Such a body remained inscribed with the values of its place of production, and carried them as it travelled. At Westminster, Reid's ventilation embodied values specific to the Edinburgh context where it was conceived. Reid maintained that he performed chemistry rather than engineering or architecture and, as he had in Edinburgh, asserted that the purpose of science was to produce useful knowledge for the improvement of man's state. An experiment produced in Edinburgh was not interpreted in the same way in Westminster, and the appropriateness of conducting research varied between the permanent and temporary Parliaments. Reid's initial ventilation

---

513 Ben Marsden and Crosbie Smith, *Engineering Empires: a cultural history of technology in nineteenth-century Britain*, (Basingstoke, 2005), pp. 6-8; for example, the Cunard Steamship Company built trust into their ships by avoiding pride and tempting providence, see Crosbie Smith and Anne Scott, '"Trust in Providence": Building Confidence into the Cunard Line of steamers', *Technology and Culture*, Vol. 48, No. 3 (Jul., 2007), pp. 471-96; for trust and questions of taxation and state spending, see Martin Daunton, *Trusting Leviathan: the politics of taxation in Britain, 1799-1914*, (Cambridge, 2001), pp. 10-1.

514 See Steven Shapin, *A social history of truth: civility and science in seventeenth-century England*, (Chicago, 1994), p. xxvi.

515 Charles W. J. Withers and David N. Livingstone, 'Thinking Geographically about nineteenth-century science', in David N. Livingstone and Charles W. J. Withers (eds.), *Geographies of nineteenth-century science*, (Chicago, 2011), pp. 1-19, 1-3.

work, produced in Edinburgh, was contingent on local cultural resources, including institutions, ideas, and social networks. These shaped Reid's work and were inseparable from his approach to chemistry. Debates within Edinburgh University, Reid's relationship with local industrial and commercial leaders, his audiences in the city including the evangelical Presbyterian Thomas Chalmers (1780-1847), and his work for Edinburgh science associations, all shaped his performance of chemical work, including ventilation. It was in this cultural context that Reid laboured to build trust into his apparatus. In Edinburgh Reid was involved in 'a quest for credibility', in-which he actively displayed his work as consistent with local cultural values.[516]

The practice of experimenting was a controversial part of this construction of credibility. Marsden and Smith distinguish between experiment, which often appeared unreliable and fragile, and experience, which could appear reliable and trustworthy.[517] However I will show how Reid sought credibility by appearing experienced and displaying experiments as producing consistent results. A big problem he faced was the use of humans in experiments. Who was the subject of an experiment was important in its apparent credibility, with individuals constructed as more reliable reporters of sensations experienced during experiments if they lacked education, freedom, or selfhood.[518] This question of managing human subjects as experimental instruments plagued Reid's transferal of skills from Edinburgh to Westminster. Performing experiments on Edinburgh students, Presbyterian ministers, and foot-guards was not the same as performing similar trials on MPs in the Commons. Indeed, while experiments on subservient soldiers in the Commons provided suitable subjects with which to impress delegates from *The Times*, such experiments were not sufficient to satisfy independent-minded elected MPs. The Lower Chamber proved a difficult space in which to control experiments and discipline those who witnessed them.[519] Although experiment

---

[516] Bruno Latour and Steve Woolgar, *Laboratory Life: the construction of scientific facts*, (Princeton, 1986), p. 200-1; Bruno Latour and Steve Woolgar, 'The Cycle of Credibility', in Barry Barnes and David Edge (eds.), *Science in context: readings in the sociology of science*, (Milton Keynes, 1982), pp. 35-43; for example, see Crosbie Smith, '"Nowhere But in a Great Town": William Thomson's spiral of classroom credibility', in Crosbie Smith and Jon Agar (eds.), *Making Space for Science: territorial themes in the shaping of knowledge*, (Basingstoke, 1998), pp. 118-46.

[517] Marsden and Smith, *Engineering Empires*, p. 10.

[518] Alison Winter, *Mesmerized: powers of mind in Victorian Britain*, (Chicago, 1998), pp. 7, 4, and 62.

[519] On the importance of disciplining laboratory spaces, compare with Robert Boyle's experiments as explored in Steven Shapin and Simon Schaffer, *Leviathan and the air-pump: Hobbes, Boyle, and the experimental life*, (Princeton, 1985), p.

could be a powerful resource for building conviction, replication to varying audiences was troublesome. To account for the success of experimental work, it is important to avoid explanations which claim experiments self-evidently reveal natural phenomena, and instead explore how experiment was constructed as a practice of representing nature.[520]

This chapter begins by examining Reid's chemistry in its urban Scottish context. 1830s' Edinburgh was a crucible in which industry, academia, and religion collided. Reid's science was conducted amid evangelical Presbyterian calls for useful work and rising concerns over rapid industrial and social change. Part two provides an account of how Reid's ventilation apparatus and chemical experiments came to the attention of Parliament between 1834 and 1835. Part three details Reid's experiments in the Commons and analyses how London audiences interpreted this ventilation system. Reid's science carried weight with audiences in Edinburgh, and he built trust with the 1835 ventilation committee, but winning that same science credibility with MPs and in wider scientific networks remained problematic. I conclude by analysing the conflict between Reid and Barry over ventilating the permanent Parliament. Reid found the change from temporary buildings to Palace an altogether different challenge. Transferring knowledge from Edinburgh to Parliament was about much more than experimental techniques. Reid's persistent investigating and absolute commitment to empirical practices won him favour with Edinburgh experimentalists like David Brewster, but the sort of knowledge he manufactured appeared unstable; what William Whewell might have labelled 'progressive' knowledge. It carried with it all the radical connotations this invoked and brought Reid into conflict with Charles Barry.

Chemistry and the Creator: the Edinburgh context of Reid's science

39; Steven Shapin, 'The house of experiment in seventeenth-century England', *Isis*, Vol. 79, No. 3, (Sep.., 1988), pp. 373-404, 373

[520] David Gooding, Trevor Pinch, and Simon Schaffer, 'Introduction: some uses of experiment', in David Gooding, Trevor Pinch, and Simon Schaffer (eds.), *The Uses of Experiment: studies in the natural sciences*, (Cambridge, 1989), pp. 1-27, 14.

1830s' Edinburgh was the site of a great collision of problems and ideas. While in England, the Anglican academic bastions of Oxford and Cambridge were separated from the rapidly industrializing regions of the North, Edinburgh witnessed dramatic economic growth, rising poverty, and religious controversy. Edinburgh University was at the centre of this radicalizing world.[521] **(Fig. 14)** New mercantile and commercial groups were finding increasing cultural and political influence, representing a challenge to the traditionally Whig and Tory dominated scientific culture.[522] Edinburgh's 'petty bourgeoisie', self-employed craftsmen and shop-keepers, came together with local lecturers, like the phrenologist George Combe (1788-1858), to form the Edinburgh Philosophic Association in 1832.[523] This association provided cheap lectures on geology and chemistry, and condemned the high fees of Edinburgh University courses.

It was in this context that from 1828 to 1833 Reid taught practical chemistry at Edinburgh University.[524] Although Thomas Charles Hope (1766-1844) held the University's chemistry chair, Reid was responsible for practical chemistry demonstrations.[525] His father, Peter Reid (1777-1838), had been an active campaigner for education reform in the city, including increased teaching of what he considered useful subjects like mathematics and modern languages. David Boswell Reid shared his father's interest in improving working-class education and was active with local medical charities promoting knowledge on health between 1830 and 1833.[526] He reduced the admission price of his chemistry classes at the University

---

[521] Crosbie Smith, *The science of energy: a cultural history of energy physics in Victorian Britain*, (London, 1998), p. 15; on how local contexts shaped contrasting engineering courses, see Ben Marsden, 'Engineering science in Glasgow: economy, efficiency and measurement as prime movers in the differentiation of an academic discipline', *British Journal for the History of Science*, Vol. 25, No. 3 (Sept., 1992), pp. 319-46.

[522] Steven Shapin, '"Nibbling at the teats of science": Edinburgh and the diffusion of science in the 1830s', Ian Inkster and Jack Morrell (eds.), *Metropolis and Province: science in British culture, 1780-1850*, (London, 1983), pp. 151-78, 153.

[523] Ibid., pp. 154-5; on Edinburgh science, see James A. Secord, *Victorian Sensation: the extraordinary publication, reception, and secret authorship of Vestiges of the Natural History of Creation*, (Chicago, 2000).

[524] See Centre for Research Collections, Edinburgh University (CRC) P.137.25, Thomas Charles Hope, 'Summary of a Memorial to be presented to the Right Honourable the Lord Provost, magistrates, and council, respecting the institution of a professorship of practical chemistry in the University of Edinburgh', p. 5.

[525] Edward J. Gillin, 'Reid, David Boswell (1805–1863)', *Oxford Dictionary of National Biography*, Oxford University Press, April 2016 [http://ezproxy-prd.bodleian.ox.ac.uk:2167/view/article/23327, accessed 17 Sept 2016]; M. F. Conolly, *Biographical Dictionary of Eminent Men of Fife, of past and present times*, (Edinburgh, 1866), p. 377.

[526] Conolly, *Biographical Dictionary of Eminent Men of Fife*, p. 376; Sturrock and Lawson-Smith, 'The Grandfather of Air-Conditioning', p. 2982.

to increase accessibility to the subject. Along with several publications, Reid's classes built him a reputation in Edinburgh as an authority on chemistry. When Richard Phillips (1778-1851), the editor of *The Philosophical Magazine*, suggested that Hope had guided Reid's *Elements of practical chemistry* and that it contained accounts of inaccurate experiments, Reid replied citing his own experience in chemical experimentation.[527]

For Reid, chemistry was important because it was the study of the world's physical resources for the improvement of mankind's condition. As Reid explained, 'unless the key to the nature of the material world be given by some explanatory lessons on science, and especially on Chemistry, the most awakening and fundamental of all the physical sciences, the power of improvement, even in civilised nations, must remain comparatively a sealed book to a large mass of the community'.[528] Reid used the example of iron to demonstrate chemistry's power in advancing civilization. Rock contained iron, but to turn this ore into a useful material could be done only 'by the powerful aid of chemical action'.[529] Reid believed that with chemistry, iron could be produced from nature and this element was the foundation of all 'civilised community'. Iron provided man with surgeon's knives, steamships, steam-engines, compasses, and all the tools of modern progress. As Reid concluded, these were the fruits of knowledge, applied to 'the properties which the Author of nature has impressed upon the material creation'.[530] In this way Reid believed knowledge which informed the manipulation of chemical elements was power because it had the potential to secure material improvement.

Reid reckoned that chemistry's greatest potential to advance the human state was through enhancing the understanding of the air man consumed. He was sure that chemical experiment, involving

---

[527] David Boswell Reid, *Elements of practical chemistry*, (Edinburgh, 1830); David Boswell Reid, *An exposure of the misrepresentations in the Philosophical Magazine and Annals, for December, 1830, in its attack upon the author's Elements of Practical Chemistry*, (Edinburgh, 1831); Richard Phillips, *A letter to Dr. David Boswell Reid, experimental assistant to Professor Hope, in answer to his pamphlet, entitled "An Exposure Of The Misrepresentations In The Philosophical Magazine And Annals," &c.*, (London, 1831); David Boswell Reid, *An exposure of the continued misrepresentations by Richard Phillips, Esq … in his attempt to vindicate himself from Dr. Reid's first exposure of his misrepresentation in that journal*, (Edinburgh, 1831).

[528] David Boswell Reid, *Illustrations of the theory and practice of ventilation, with remarks on warming, exclusive lighting, and the communication of sound*, (London, 1844), p. xii.

[529] Ibid., p. 5.

[530] Ibid., p. 9.

repeated examinations and testing on air both before and after human respiration, would yield knowledge which could be applied to improve health. Reid believed that disease was spread by certain chemicals distributed in the atmosphere, and that to observe how air changed chemically when passing through the human-frame revealed insights into what constituted healthy air. Reid's work was intended to be transformative in a society fearful of disease and often convinced by miasmic theories of its spread through bad air from decaying vegetation and waste. He calculated that a human, on average respiring twenty times a minute, consumed 10% of the oxygen in the air in-taken by volume. In turn, 7.8% of the air discharged was transformed into carbonic acid.[531] Reid believed this consumption of oxygen demonstrated 'the provisions which the Creator has made for giving it [the human-frame] power and endurance'.[532] Oxygen was 'the great agent which the Author of Nature has created for the more immediate support of animal and vegetable life'.[533] As human respiration was contingent on this chemical conversion of oxygen into carbonic acid, Reid maintained that to build architecture which aided human health called for the application of ventilation apparatus. Chemical knowledge of human 'respiration, combustion, and ventilation', was to be 'made a more especial object of attention in the construction of every kind of building'.[534]

Between 1833 and 1835, when Reid ran a private classroom for chemistry demonstrations, he constructed a system of ventilation in the building to extract fumes from experiments. This apparatus was itself conceived of as an experiment in regulating the chemical composition of a building. According to Reid, homes, ships, and churches should be built on the principle of removing corrupted air, filled with carbonic acid, and replacing it with an oxygen rich atmosphere. He used the example of crowded churches to illustrate the problems of vitiated air, describing how,

> The power of the clergyman is often reduced as well as the attention of the congregation. Too often he does not recognise the darkness of the physical atmosphere that, at times,

[531] Ibid., pp. 16-7.

[532] Ibid., p. 19.

[533] David Boswell Reid, *Brief outlines illustrative of the alterations in the House of Commons, in reference to the acoustic and ventilating arrangements*, (Edinburgh, 1837), p. 10.

[534] CRC S.B.5404/2*13, David Boswell Reid, 'The Study of Chemistry: its nature, and influence on the progress of society: importance of introducing it as an early branch of education in all schools and academies', p. 12.

> oppresses all his labours, and counteracts or diminishes his usefulness, as much by the power with which it subdues his own energies, as by the careless indifference which it encourages in his congregation. At the very moment that he may be … pointing out the purifying power of that moral atmosphere which should surround the heart; how often are his labours shorn of their power by the physical poison that sometimes paralyses the best intentions.[535]

The power of improved air was analogous to the power of improved morality. Ventilation facilitated superior conditions for health and worship. In the space of the church, this use of scientific knowledge appeared particularly righteous, with atmospheric purification assisting spiritual purification. As iron ore was in place in rock for man's progress, so too was pure air in the atmosphere for his existence. Chemistry was the ubiquitous tool to harness both. Reid explained that 'Innumerable resources have been provided by an all-bountiful Providence for ministering, perhaps indefinitely, to the necessities, as well as to the comforts of life'.[536]

For Reid, ventilation was chemistry because it involved the manipulation of atmospheric elements, as well as the understanding of the physical qualities of elements such as oxygen. Yet Reid held specific views of what exactly chemistry was, what it was for, and how it should be conducted. These views place Reid firmly within the Edinburgh context in which he laboured, where the boundaries between the city's rapidly industrializing society and the academic work conducted at the university were hard to distinguish. Reid clearly defined his concept of chemistry during a controversy surrounding a proposed practical chemistry chair for the university between 1833 and 1834. Rather than a simple debate over the establishment of a new chair, Reid's attempt to reform the existing programme of chemistry at the university was a contest between what he perceived was theoretical science, and the practical application of knowledge to the improvement of society. Reid argued that the proper place of chemistry was outside of the laboratory.

---

[535] Reid, *Illustrations*, p. 44.

[536] Ibid., p. xi.

Having run practical chemistry classes as Hope's assistant, Reid understandably felt himself to be the most suitable candidate for the new chair. New university appointments were controversial however, with Edinburgh Whigs and Tories often keen to reject reforms that might be seen to hand influence to the city's commercial groups.[537] Reid's proposed practical chemistry chair threatened to do just this. Reid lobbied the Town Council to call for the university to recognise the importance of practical chemistry in its own right: 'It is necessary for all who study Chemistry for any scientific or practical purpose. Its connection with our arts and manufactures is becoming daily more intimate'.[538] Reid offered, 'in the strictest sense, a Course of Chemistry applied to the Arts (including Medicine) and Manufactures'.[539] Practical chemistry offered such potential for improvement in agriculture, art, and manufacturing that it was inappropriate that such knowledge should remain in the domain of Dr Hope's assistants.[540]

Reid's appeal found support in the city, uniting an impressive combination of academics and manufacturers: a network displaying Reid's prominence in Edinburgh's academic and industrial communities. John Baird of the Shotts Iron-Works, James Hay of the Edinburgh Ropery, and John Macfie, owner of the Edinburgh Sugar Works all provided testimony as to the utility of Reid's science.[541] Thomas Dick Lauder, vice-president of the Society of Arts, heralded Reid's interest 'in the advancement of science'.[542] Civil engineers James Leslie and Robert Stephenson also praised Reid's experimental knowledge as beneficial to their own works, while the physician Neil Arnott (1788-1874) spoke in favour of the appointment.[543] Yet Reid's support from within the University was evident too, with George Joseph Bell,

---

[537] Shapin, "'Nibbling at the teats of science'", p. 158.

[538] David Boswell Reid, *A Memorial to the patrons of the University on the present state of practical chemistry*, (Edinburgh, 1833), p. 3.

[539] CRC P.89.16, David Boswell Reid, 'Remarks on Dr Hope's "Summary," presented to the patrons of the University', p. 11.

[540] Reid, *A Memorial*, p. 4.

[541] CRC P.89.19, David Boswell Reid, 'Testimonials regarding Dr D. B. Reid's qualifications as a lecturer on chemistry, and as a teacher of practical chemistry', (1833), pp. 15, 10 and 20-1.

[542] Ibid., pp. 13-4.

[543] Ibid., pp. 1-2, 54, 42.

Professor of Scottish Law; James Pillans, Professor of Humanity; and the late John Leslie, Professor of Natural Philosophy, all advocating the creation of the new chair.[544]

However the university rejected Reid's bid to secure academic employment. Hope felt threatened by Reid's application and opposed Reid's claims on the grounds that theoretical chemistry was inseparable from practical experimentation and that his lectures already embraced practical displays of eight to nine hundred chemical processes.[545] He argued that the creation of two chairs for what he considered to be one subject would create a dangerous precedent throughout the university, particularly in Theology, Natural Philosophy, and Scottish Law.[546] Unsurprisingly these specified subjects were those in which Reid's supporters worked. Practical chemistry belonged to the chemistry chair and could not 'constitute a proper object of a separate Chair'.[547] Hope referenced the experience of forty-thousand experiments and thirty-eight years of teaching to his credit. He undermined Reid's reputation by hinting at Reid's interest in a new chair as mercenary. Reid responded with a vigorous defence of both his own integrity and of the proposed chair. He argued that his classes had run at a financial loss, while his position as Hope's assistant 'took away much from Dr Reid's professional standing', as well as from the importance of the subject.[548] He described Hope's teaching as purely theoretical, arguing that 'in the estimation of the public', especially in Edinburgh, the practical element of chemistry was what really mattered.[549] The proposed chair would therefore be more appropriate to the 'progress of science and the interests of the public'.[550] It was constructed as a relevant position for a university situated in the heart of a rapidly changing city.

Nevertheless, Hope found much support in favour of maintaining the status quo, and in doing so raised important questions over Reid's claims for science's role in society. John Wilson Anderson had run

---

[544] Ibid., pp. 5-7, 51, 65-6.

[545] CRC P.137.25, Hope, 'Summary of a memorial', p. 6; Jack Morrell, 'Hope, Thomas Charles (1766–1844)', *Oxford Dictionary of National Biography*, Oxford University Press, 2004 [http://ezproxy.ouls.ox.ac.uk:2117/view/article/13738, accessed 5 April 2013].

[546] CRC P.137.25, Hope, 'Summary of a memorial', p. 8.

[547] Ibid., p. 4.

[548] CRC P.89.16, Reid, 'Remarks on Dr Hope's "Summary"', p. 6.

[549] Ibid., pp. 9-10.

[550] Ibid., p. 11.

Hope's practical chemistry classes before 1828. Anderson defended Hope, casting doubt on Reid's assertions that practical chemistry could be applied outside of the laboratory. He believed that 'No greater delusion can exist than to suppose that such Practical instruction is to be obtained in the Laboratory, any more than that it can be obtained in the Lecture-room'.[551] Anderson argued that the university laboratory was not a place of acquiring practical knowledge, but creating theoretical evidence of the properties of elements and compounds. The problem, as he saw it, was that a laboratory was a site of theoretical knowledge production but was not big enough to trial new methods and apparatus on an industrial scale. In a laboratory one could observe natural phenomena, but one could not see how chemistry could be applied to practical problems. He argued that places of practical knowledge, like breweries and glasshouses, were built for specific arts and therefore more appropriate places to work out improvements in manufacturing. A laboratory was built to investigate chemical laws while factories were places of industry. Anderson acknowledged that 'Scientific knowledge and Practical Skill ought ever to go hand in hand', but also warned that Reid was deluded to think he offered genuine practical knowledge from his laboratory.[552]

The Town Council made a second attempt to secure a new chair for Reid in 1834, but the university rejected this.[553] On Hope's retirement in 1843, Reid applied for his chemistry chair, considering it to have 'so long exerted a powerful influence on the progress of Science', but this too was turned down.[554] Anderson maintained that Reid risked 'reducing their [scientific chemists'] knowledge to the actual business of life'.[555] Hope's supporters constantly asserted that in a university environment, the role of practical chemistry was to demonstrate general principles rather than shape daily life. William Gregory, an ex-student

---

[551] John Wilson Anderson, *Letter to the Right Honourable the Lord Provost, magistrates, and Town Council of Edinburgh, as patrons of the University, in reference to the contemplated establishment of a lectureship of practical chemistry*, (Edinburgh, 1834), p. 4.

[552] Ibid., p. 6.

[553] J. B. Morrell, 'Practical chemistry in the University of Edinburgh, 1799-1843', *Ambix*, 16, Issue 1-2 (1969), pp. 66-80, 75; also see David Boswell Reid, *A letter to the Right Honourable the Lord Provost, magistrates, and council, patrons of the University Of Edinburgh, on the present state of practical chemistry: with remarks on some statements in a pamphlet by Dr Anderson, assistant to Dr Hope*, (Edinburgh, 1834).

[554] David Boswell Reid, *Professorship of chemistry in the University of Edinburgh: testimonials in favour of Dr D. B. Reid, F. R. S. E.*, (Edinburgh, 1843), p. v.

[555] John Wilson Anderson, *Postscript of a letter to the Right Honourable the Lord Provost, magistrates, and Town Council of Edinburgh, as patrons of the University, in reply to a pamphlet by Dr. Reid, lecturer on chemistry, in reference to the contemplated establishment of a lectureship of practical chemistry*, (Edinburgh, 1834), p. 2.

of Hope's, claimed Reid's proposals risked creating a course which paid insufficient attention to theory.[556] Robert Christison, the holder of the Edinburgh Chair of Materia Medica, joined in the criticism with a strongly worded address to the Town Council. Christison disliked Reid's teaching, believing it to be too much 'in the recruit drill-sergeant fashion'. He felt that Reid's students 'came out of his hands ignorant of the simplest manipulations in practical medico-chemistry'.[557]

Although Reid's proposed practical chemistry chair was rejected and he subsequently left the university's employment, the support he attracted demonstrates that there was an understanding among some of Edinburgh's commercial and academic groups that Reid's work was credible. Within the network of industrialists and academics that supported Reid's appointment was an agreement that he and his work were trustworthy. In Edinburgh there was a consensus that science should be practical, by which it was meant that knowledge was most useful if it was conceived of for social improvement. Reid portrayed his work as consistent with such values. Appropriately, he had been an officer in George Combe's Society for Aiding the General Diffusion of Science. Combe led the organization, seeking to remove Tory-Whig patronage from science and to promote its progressive nature beyond the confines of Edinburgh's social elites.[558] While Combe's emphasis on reforming and secularizing Edinburgh science aroused the disapprobation of Whigs, Tories, and the Presbyterian Church, Reid found favour with some from these circles. As Combe struggled to make his science appear apolitical and avoid allegations of irreverence, Reid's work fitted well within Edinburgh's increasingly diverse religious and political culture.[559]

Indeed this religious context is important to understand how Reid's work earned the credibility which it did. One of Reid's keenest promoters was the charismatic leader of the Evangelical Party of the

---

[556] See William Gregory, *Observations on the proposed appointment of a teacher of practical chemistry in the University; with remarks on some passages in Dr Reid's letter to the council on the subject*, (Edinburgh, c.1834); David Boswell Reid, *A letter to The Right Honourable the Burgh Commissioners, on the evidence of Dr Christiston, Professor of Materia Medica in the University Of Edinburgh*, (Edinburgh, 1835).

[557] Brenda M. White, 'Christison, Sir Robert, first baronet (1797–1882)', *Oxford Dictionary of National Biography*, Oxford University Press, 2004; online edn, Oct 2009 [http://ezproxy.ouls.ox.ac.uk:2117/view/article/5370, accessed 8 April 2013]; Robert Christison, *The Life of Sir Robert Christison, Bart*, (Edinburgh, 1885), p. 344.

[558] Shapin, '"Nibbling at the teats of science"', pp. 163-4; on Whigs and natural philosophy in Edinburgh at this time, see L. S. Jacyna, *Philosophic Whigs: medicine, science and citizenship in Edinburgh, 1789-1848*, (London, 1994).

[559] Shapin, '"Nibbling at the teats of science"', pp. 159 and 163.

Church of Scotland, the Rev Thomas Chalmers.[560] This support for Reid was important because in 1830s' Edinburgh, Chalmers was at the centre of evangelical interpretations of science: interpretations which were becoming increasingly prominent in society. Bebbington identified nineteenth-century evangelicalism as having four main characteristics. These included a call to conversion (by repenting, which entailed turning from one's self to God and accepting Christ's message), activism (the imperative of bringing others to Christ), a focus on the Gospels (emphasizing Christ's suffering on the Cross and doctrine of Atonement), and a commitment to the Bible as the absolute truth and word of God, to be adopted as a guiding compass.[561] Hilton has shown that these values intrinsically shaped nineteenth-century thought in politics, philanthropy, and natural philosophy.[562] Nowhere was this more apparent than in the Edinburgh circles where Reid sought to make his name.

Chalmers held the theology chair at Edinburgh University from 1828 and, in the years prior to the 1843 disruption of the Presbyterian Church and formation of the Free Church of Scotland, was a prominent member of the network of Edinburgh academics in which Reid built his reputation.[563] Chalmers taught that suffering was a source of improvement, existing to guide men to virtue. Hilton has argued that Chalmers was the most influential preacher of this distinctive attitude, so much at variance to the more 'extreme' evangelical conviction that suffering was simply a sign of sin and depravity. Instead, the natural world was 'an arena' in which man could bring about redemption.[564] Chalmers' Calvinist interpretation of the universe existing in a state of depravity and doomed to inevitable decay had social ramifications. Chalmers advocated minimal government interference, free-trade, *laissez-faire*, and self-help, because such approaches to politics and society allowed for individual, personal morality.[565] Too much charity would

---

[560] Hugo Reid, *Memoir of the Late David Boswell Reid*, (Edinburgh, 1863), pp. 11-2.

[561] D. W. Bebbington, *Evangelicalism in Modern Britain: a history from the 1730s to the 1980s*, (London, 1989), pp. 2-3.

[562] Boyd Hilton, *The Age of Atonement: the influence of evangelicalism on social and economic thought, 1785-1865*, (Oxford, 1986); on evangelicalism and science, see David N. Livingstone, D. G. Hart, and Mark A. Noll (eds.), *Evangelicals and Science in Historical Perspective*, (Oxford, 1999).

[563] Stewart J. Brown, 'Chalmers, Thomas (1780-1847).', *Oxford Dictionary of National Biography*, Oxford University Press, 2004; online edn, Oct 2007 [http://www.oxforddnb.com/view/article/5033, accessed 26 Dec 2012]; Conolly, *Biographical Dictionary of Eminent Men of Fife*, pp. 111-3.

[564] Hilton, *The Age of Atonement*, p. 55.

[565] Smith, *The science of energy*, pp. 19-20.

create indolence, while free-trade and enhanced personal liberties nurtured conscience through trials, sufferings, and temptations. Quite unlike Utilitarian philosophy, Chalmers' approach to life was not about generating material happiness, but the moral regeneration of society.[566] Alternately, Chalmers taught that the best use of one's time and wealth was to invest it for the improvement of humanity.[567] Chalmers' Presbyterian understanding of 'giving' was not charity, but the maximizing of useful work and the minimizing of idleness and waste.

In the early-nineteenth century, the Evangelical Party of the Church of Scotland's General Assembly adopted a position as defender of the intellectual freedoms of Edinburgh University academics.[568] By the 1830s, Chalmers had very much become the champion of this Edinburgh evangelicalism.[569] His theology held resonance for science in nineteenth-century urban Scotland.[570] In Edinburgh and Glasgow, rising poverty and industry made Chalmers' teachings appear increasingly urgent. For Chalmers, natural science offered a powerful means of understanding the natural laws of the material world. Yet it was natural theology, combined with the scriptural truths of the Gospels, which provided him with an explanation for nature's working. True religion combined both reason and feeling.[571]

---

[566] Ibid., p. 20; Hilton, *The Age of Atonement*, p. 7.

[567] Smith, *The science of energy*, p. 22.

[568] This position began in 1805 with John Leslie's bid to secure the chair of mathematics at Edinburgh University. Leslie had in a footnote endorsed David Hume's controversial doctrine of causation which taught that cause and effect were in constant sequence. This implied a shift from seeking 'proofs' to 'inklings' of Divine truth which found support from freethinking members of the Evangelical Party but aroused contempt from the Moderate Party of the Assembly; see Hilton, *The Age of Atonement*, pp. 24-5; Jonathan R. Topham, 'Science, Natural Theology, and Evangelicalism in Early Nineteenth-Century Scotland: Thomas Chalmers and the evidence controversy', in Livingstone, Hart, and Noll (eds.), *Evangelicals and Science*, pp. 142-74, 146-9.

[569] David W. Bebbington, 'Science and Evangelical Theology in Britain from Wesley to Orr', in Livingstone, Hart, and Noll (eds.), *Evangelicals and Science*, pp. 120-41, 123.

[570] Smith places Chalmers in the scientific tradition of William Thomson (later Lord Kelvin) and James Clerk Maxwell, and with Scott shows how his shared values with George Burns and Robert Napier shaped the running of the Cunard Steamship Company; see Crosbie Smith, 'From Design to Dissolution: Thomas Chalmers' debt to John Robison', *The British Journal for the History of Science*, Vol. 12, No. 1 (Mar., 1979), pp. 59-70, 67; Smith and Scott, ""Trust in Providence"", pp. 471-96.

[571] Evangelicalism emphasised the desire to 'feel' the Atonement, see Hilton, *Age of Atonement*, p. 20.

According to Chalmers, the problem of nature was that 'all her elements are impregnated with disease … Even the mute and inanimate things are subject to the power of a decay'.[572] Science revealed the natural laws of motion and matter but showed the state of the world, from mountains to human life, to be in this state of perpetual decay. Only by God's omnipotent power of renewal could these laws be maintained. Natural laws 'created and sustained by God's will' presented the evangelical Chalmers with the most 'palpable argument' for God's existence; the eternal power of God was revealed by knowledge, yielded through science, of the transitory character of laws of nature.[573] While he was occasionally criticized for his attention to academic evidence, rather than the Gospel message, Chalmers' Natural Theology of Conscience, which taught that the supremacy of the human conscience was strong evidence for a Divine architect, secured him influence in evangelical circles.[574] An evangelical disposition taught that God's presence could be seen in every act of nature, and Man's duty was to work in accord with such divinity. While a theological understanding of natural philosophy was central to Chalmers' conception of scientific knowledge, 'experiment' and 'discovery' were valued as the means to cause 'science in conjecture … to become science in certainty'. Experiment, particularly in chemistry, could serve to 'clear up many of the most recondite problems in physics, and thereby incalculably to extend the boundaries of our present science'.[575]

Chalmers was a keen supporter of scientific works which he felt to be consistent with his teachings and this included Reid's enthusiastic promotion of chemistry. Chalmers frequently attended Reid's experimental classes, believing the lectures exhibited the most 'lucid exposition' Edinburgh had to offer.[576] Reid displayed his work as consistent with evangelical readings of nature which considered the practice of science as Divinely sanctioned. He explained how,

> It has pleased the Author of nature so to form man, that he is forced to attend to the objects with which he is surrounded, and the most of his senses have been given him for

[572] Chalmers, quoted in, Smith, 'From Design to Dissolution', p. 62.

[573] Ibid., pp. 62-4.

[574] Topham, 'Science, Natural Theology, and Evangelicalism', p. 165.

[575] Chalmers quoted in (Anon.), 'Address to Dr Samuel Brown', *The Scotsman*, (Apr., 29, 1843), p. 2.

[576] Hugo Reid, *Memoir*, p. 11.

> this purpose. This world, then, is the arena on which man is called at present to act; the materials of happiness are placed before him, but his skill, activity, and knowledge, are required to enable him to make a proper use of them. He is called upon to obey this great law by the first instincts and most imperious wants of his nature; and it is to the difficulties he has to contend with under such circumstances, that we owe the development of many of the more ennobling qualities of the human mind.[577]

The acquisition of chemical knowledge was the appropriate application of the human senses to understanding God's natural laws. This knowledge could allow man to use such laws to improve his own condition. Even though materials were provided for man's use, Reid believed that to benefit from them required disciplined study. Reid continued that,

> To study the laws of nature, then, is to study the laws which the Author of nature has ordained for the happiness and improvement of the human race; and it is not only to ignorance or neglect of the duties which morality and religion have imposed, but also to our ignorance or neglect of those physical laws, that a large share of most of the evils of life can be traced. The physical sciences, then, which investigate these laws, and apply them to the purposes of life, not only form a most essential part of that knowledge which is most necessary to man, but every step we advance tends more and more to exalt our ideas of the wisdom, power, and beneficence of their Author. It is impossible to contemplate the progress of society without seeing how much man is indebted to the cultivation of physical science.[578]

Through experiment, it was possible to reveal and benefit from God's laws. Reid's interpretation suggested scientific investigation was a trial, not only of diligence, but also of morality. Knowledge of nature was knowledge of the Divine, and the pursuit of this would be rewarded by progress.

---

[577] CRC, S.B.5404/2*13, David Boswell Reid, 'The study of chemistry', p. 3.

[578] Ibid., p. 3.

Chalmers posited a very similar understanding of the material world in his volume of the *Bridgewater Treatises*, financed from the will of the Earl of Bridgewater for work displaying the 'power, wisdom, and goodness of God' through scientific discovery. Referring specifically to the 'moral elements' which the Author of Creation provided, Chalmers described the relationship between virtue and the materials of progress: great was 'the capacity of that world in which we are placed for making a virtuous species happy'.[579] The elements of physical and moral happiness were, as Reid proposed, provided. It fell to 'the aptitude of the human understanding, with its various instincts and powers, for the business of physical investigation' to make use of these materials.[580] The 'experimental truth' of material nature was to be collected 'by a diligent observation of facts and phenomena'.[581] Through Chalmers, Reid's understanding of nature can be placed firmly within a Scottish evangelical context.

Reid invited Chalmers' wife and children to attend his classes free of charge, and the two men socialized regularly at dinners and meetings over tea. Chalmers applauded Reid's application and understanding of chemical science. Having attended several of Reid's practical chemistry classes at the university, Chalmers recommended Reid for the practical chemistry chair, expressing the

> pleasure and instruction which I received during my attendance … on your course of popular lectures, where, besides the utmost expertness and address in all the manipulations of Chemistry, you evinced, and more particularly in your lucid exposition of the Atomic Theory, both how thoroughly you had comprehended, and how successfully you could communicate, the principles of the Science.[582]

[579] Thomas Chalmers, *The Bridgewater Treatises: on the power wisdom and goodness of God as manifested in the adaption of external nature to the moral and intellectual constitution of man*, Vol. II, (London, 1833), p.117.

[580] Thomas Chalmers, *The Bridgewater Treatises: on the power wisdom and goodness of God as manifested in the adaption of external nature to the moral and intellectual constitution of man*, Vol. I, (London, 1833), p. 9.

[581] Ibid., p. 11.

[582] CRC P.89.19, Reid, 'Testimonials', p. 12.

Reid valued Chalmers' praise and enjoyed reading the theologian's own works, finding them always to be a 'source of pleasure'.[583] Chalmers' support shows how Reid's work was valued in Edinburgh as consistent with his evangelical teachings.

Between Reid and Chalmers, the common interest in the application of science to the material improvement of society was a regular topic of conversation. In 1832 Reid wrote to Chalmers that

> I have been rambling thro all the principle manufacturing towns in England … One of the most interesting novelties which I saw was a Hydro-Static Bed, invented a few weeks ago by Dr. Arnott of London. It appeared to me so valuable an invention, that I lost no time in getting one made here, and I am sure you will be much pleased with it when you see it and *try* it.[584]

This hydrostatic bed, which maintained equal pressure throughout a mattress to reduce the chance of bed-ridden patients developing sores, promised the sort of material improvement which Chalmers had emphasized throughout his career. Chalmers had, in his years at the Tron Church in Glasgow (1815) and the parish of St John's (1819), attended not only to the spiritual welfare of his parishioners, but also to their material improvement. He felt that the biggest threat to material progress was a lack of education among the urban working classes, combined with increased population. Among his congregations, he promoted the values of thrift, delayed marriage, and limited child-birth, but also encouraged self-help and communal responsibility as he sought to revive a general community spirit. Although statistical science was his principal answer to the threat of Malthusian population growth, practical improvements, such as the hydrostatic bed, were appreciated in Chalmers' moral philosophy.[585] Reid shared Chalmers' concerns for social improvement through enlightenment. Indeed he 'regretted much that my classes for practical chemistry have always met at the same hours at which you lecture, preventing me from attending you, and studying a subject to which I was anxious to have devoted my whole time'. Chalmers sent papers covering

---

[583] New College Library, Edinburgh University (NCL), CHA4.213.1, 'Letter from David Boswell Reid to Thomas Chalmers', (12 Jan., 1833).

[584] NCL CHA4 188.60-61, 'Letter from David Boswell Reid to Thomas Chalmers', (11 Sep., 1832).

[585] Brown, 'Chalmers, Thomas (1780-1847).', *Oxford Dictionary of National Biography*.

the content of his lectures, of which Reid reported that he was 'busily engaged in studying it … particularly your views as to a compulsory provision for the poor, and of the Christian education of the people'.[586] Reid fully endorsed Chalmers' prescribed education of the poorer classes.

Reid's work was consistent with, and shaped by, local religious and industrial values. As his brother Hugo concluded, Reid had been destined for the medical profession had it not been for the 'growth of the science of chemistry … with its numerous and daily increasing applications to the arts and manufactures'. It was this expansion which had convinced Reid of the advantage of 'acquiring practical skill in the art of experimenting'.[587] Reid's lectures, emphasizing chemistry's potential to improve society, arts, and manufactures, were attended by hundreds of 'miners, manufactures, engineers, [and] agriculturalists'.[588] In Edinburgh, Reid's work secured trust and credibility with significant parts of these social groups. When he eventually left for London in 1840, the Edinburgh School of Arts summarized this as it celebrated his departure as an act of spreading Christian 'useful knowledge' beyond the Athens of the North to the capital of empire. It heralded Reid's chemistry as a great work of 'philanthropy'. Before presenting him with a watch to remind him of his Edinburgh heritage, Reid was praised for revealing 'the workings of Him with whom there is no shadow of turning', and for basing all his philosophy and philanthropy 'upon a sound Christianity'.[589] This reference invoked the New Testament's Epistle of St James which specified that all good gifts were from an unchanging, permanent God, and therefore Reid's works were, as ways of improving health, Divine gifts. In London Reid worked to continue this promotion of Christian science as a tool of social improvement. Reid delivered a series of lectures in 1842 at the evangelical bastion of Exeter Hall on the 'Chemistry of Daily Life'. This course, of a 'practical character', was aimed at school masters and teachers.[590] The Privy Council Office issued 1,000 tickets to London teachers and promoted the lectures to MPs. Reid boasted how his lectures preceded a government commission into public health by

[586] NCL CHA4 188.59, 'Letter from David Boswell Reid to Thomas Chalmers', (15 Feb., 1832).

[587] Hugo Reid, *Memoir*, p. 7.

[588] Ibid., p. 8.

[589] (Anon.), 'Soiree and testimonial to Dr D. B. Reid', *Caledonian Mercury* (Edinburgh, Scotland), 18 Apr., 1840; Issue 18765.

[590] (Anon.), 'Ventilation, lighting, and warming of school-rooms.- Dr. Reid's lectures', *The Morning Chronicle* (London, England), 26 Mar., 1842; Issue 22574.

over a year.[591] He later sat on this commission, examining the state of large towns and populous districts, and investigating the condition of the poorer classes in terms of water supply, drainage, dwellings, and ventilation.[592] Through such activities Reid tried to disseminate his chemical knowledge to audiences who could utilize it for social progress.

Edinburgh science for national audiences

Following Edinburgh University's refusal to grant Reid a chair in 1833, he left his post and constructed a classroom just behind the hall of the College of Surgeons. **(Fig. 15)** It was here that he ran private practical chemistry classes. Reid intended the building to be an ideal site of experiment, with the pillars of the classroom inscribed with chemical formulae.[593] Having built it through the winter of 1833-4, Reid conducted a series of experiments to various public audiences. In March 1834 he invited prominent members of Edinburgh society, including the Lord Provost and Chalmers to witness the lack of echo and clear sound attained in the room. Reid informed Chalmers that, an 'experiment is to be made in my class room on Friday, the 21st … there will be both vocal and instrumental music that it may be contrasted with other buildings in this respect. All who have hitherto tried it … stated that it is better adopted for all these principles than any room they have ever been in'.[594] Reid's guests were treated to St Cecilia's Society's vocal and instrumental performance, revealing 'the beauty of the different musical compositions'.[595] Reid attributed the pure sound to a low ceiling, elevated in the middle with an inclination of the roof and an absence of concave areas in the structure. Most importantly however, he boasted that the classroom

[591] David Boswell Reid, *Narrative of facts as to the New Houses of Parliament*, (London, 1849), p. 12.

[592] *First Reports of the Commissioners for inquiring into the state of large towns and populous districts*, PP. 1844 (572), p. v; Reid's association between air and health was consistent with contemporary miasmic accounts of disease, see Benjamin Ward Richardson, *The Health of Nations: a review of the works of Edwin Chadwick, with a biographical dissertation*, Vol. II, (London, 1887), p. 58.

[593] Sophie Forgan, 'Context, image and function: a preliminary enquiry into the architecture of scientific societies', *British Journal for the History of Science*, Vol. 19, Iss. 1, (Mar., 1986), pp. 89-113, 113.

[594] NCL CHA4.227.68, 'Letter from David Boswell Reid to Thomas Chalmers', (15 Mar., 1834).

[595] (Anon.), 'Communication of sound in public buildings', *Caledonian Mercury*, (Edinburgh, Scotland), 24 Mar., 1834; Issue 17583.

provided absolute atmospheric control. As experiments were conducted, fumes accumulated in the class, but these could be drawn out by a current created by the generation of heat outside the room in a chamber connected to perforations in the roof.

The physical shape of the interior contributed to good acoustics, but Reid believed that sound was dependent on the atmosphere for its communication. It was significant then that any experiment of sound performed was accompanied by an explanation of the extraction of vitiated air. Reid recalled how,

> on several occasions, gentlemen may have come in from a distance, foreigners and strangers, to see the working of my ventilating apparatus … we have put on the fire with a few pieces of wood, and in the course of five minutes we were able with that to bring it into such a state of activity that fumes produced in showing some experiments were carried with great rapidity by those ventilators, which in the course of three minutes would have filled the room to such an extent that we should have been obliged to go out.[596]

Two events raised the profile of Reid's classroom. These two celebrations brought together men of science and politics, transforming Edinburgh into an arena in which Reid could demonstrate his ventilation apparatus to national audiences. The first of these was the 1834 Edinburgh BAAS meeting. On 13 September 1834 Lord Brougham arrived for the final day of the fourth BAAS meeting, which celebrated Edinburgh's scientific prominence.[597] As part of the meeting, a tour of Reid's practical chemistry classroom was organized, where his elaborate system of ventilation was on show. On the concluding evening of the meeting, Reid demonstrated his control over the classroom's atmosphere to an audience including a delegation from Parliament. Earl Grey, Lord John Campbell, the Marquis of Tweeddale, and Brougham

[596] *Report from Select Committee on the Ventilation of the Houses of Parliament; with the minutes of evidence*, PP. 1835 (583), pp. 37-8.

[597] Jack Morrell and Arnold Thackray, *Gentlemen of Science: early years of the British Association for the Advancement of Science*, (Oxford, 1981), p. 103.

all attended.[598] Brougham 'examined all the arrangements of the practical class. He also paid particular attention to the system of ventilation'.[599]

A native of Edinburgh, Brougham had a sustained interest in the natural sciences. Between 1808 and 1809 he had reviewed Humphrey Davy's Bakerian Lectures on electricity, and until the 1830s he authored many articles on chemistry, optics, and astronomy in the *Edinburgh Review*.[600] Having matriculated at Edinburgh University in 1792, Brougham was a keen advocate of anti-hypothetical Baconian science. The legacy of the natural philosopher Francis Bacon (1561-1626) and the meaning of Baconian science was increasingly controversial in the nineteenth century. Bacon was a troublesome figure for some Whigs, given his association with the Royal authoritarianism of James I and his career's termination following allegations of corruption.[601] At the same time Bacon's scientific method came under criticism in the 1820s. For example, David Brewster criticized Bacon's total rejection of hypothesis. Brewster believed hypothesis without the scrutiny of experiment lacked value, but equally he felt science without any hypothesis was so limiting of imagination that it undermined the process of scientific discovery.[602] Facts alone, as Bacon prescribed, lacked originality; Brewster argued that they needed interpretation and this involved man's inventive faculty. Brougham avoided these doubts, with hypothesis appearing to him as mere 'work of fancy'.[603] Hypothesis, he believed, was non-scientific practice because it required constant adaption to suit the results of experiment. Brougham argued that if a hypothesis was correct, it was simply a description of facts.[604] He felt that science was the pursuit of truth and that the best way to achieve this was through experiment. Like Reid, Brougham was confident that science promised material improvement. Displays of the practical value of knowledge were consistent with the celebrated Baconian concept that science's

---

[598] Reid, *Illustrations*, p. 312.

[599] (Anon.), 'The Lord Chancellor', *Preston Chronicle*, (Preston, England), 20 Sep., 1834; Issue 1151.

[600] Joe Bord, *Science and Whig Manners: science and political style in Britain, c.1790-1850*, (Basingstoke, 2009), pp. 45-6; Davy (1778-1829) delivered seven of the Royal Society's prize Bakerian lectures between 1806 and 1826.

[601] Bord, *Science and Whig Manners*, p. 73.

[602] Richard Yeo, 'An idol of the market-place: Baconianism in nineteenth-century Britain', *History of Science*, Vol. 23, No. 3, (Sep., 1985), pp. 251-98. 278.

[603] Bord, *Science and Whig Manners*, p. 49.

[604] Ibid., p. 50.

goal should be 'the relief of man's estate'.[605] While Bacon's methodological legacy was debated, his association with the idea that knowledge was a means to material wealth and comfort found favour with Whigs like Brougham.[606] Reid approved of Brougham's own works to improve education. Following Brougham's association with Birkbeck's London Mechanics' Institute in 1824 and his role in founding the Society for the Diffusion of Useful Knowledge (SDUK) in 1826, Reid praised Brougham as a champion of progressing education.[607] He asserted that few had done more to advance 'the state of the mind in youth'.[608] Considering his visit to the classroom pre-dated the destruction of Parliament by little over a month, it can be seen how, when the problem of ventilating the temporary houses in 1835 arose, Reid's work had already received much attention. As Lord Campbell put it, 'on account of the fame you had acquired from the construction of your Class-room in Edinburgh, you were called in'.[609]

The classroom demonstration of 13 September 1834 was not Reid's only opportunity to impress parliamentary audiences. Two days after the BAAS concluded its proceedings, a banquet was held in honour of Earl Grey. This tribute to Grey's career came at the invitation of the Lord Provost of Edinburgh. It followed closely behind the BAAS meeting so as to ensure that a great many notable figures would still be assembled in the city.[610] 'The Grey Festival' was a very Scottish celebration of 'her Patriot Grey', who although English was proclaimed to be Scotland's closest friend.[611] While the BAAS meeting provided Edinburgh with a spectacle of science, the festival was Edinburgh's homage to Whig reform.[612] Following a huge demand for tickets and so it was resolved that a large temporary pavilion would be erected. The festival's organizers appointed Thomas Hamilton (1784-1858) as architect, with Reid to advise on

---

[605] Yeo, 'An idol of the market-place', p. 257.

[606] Bord, *Science and Whig Manners*, p. 74.

[607] Michael Lobban, 'Brougham, Henry Peter, first Baron Brougham and Vaux (1778–1868).', *Oxford Dictionary of National Biography*, Oxford University Press, 2004; online edn, Jan 2008 [http://ezproxy.ouls.ox.ac.uk:2117/view/article/3581, accessed 28 March 2013].

[608] Reid, 'The study of chemistry', p. 1.

[609] Reid, *Professorship of chemistry in the University of Edinburgh*, p. 9.

[610] Henry Brougham, *The life and times of Henry Lord Brougham written by himself in three volumes*, Vol. III, (Edinburgh, 1871), pp. 414-5.

[611] John Black Gracie (ed.), *The Grey Festival; being a narrative of the proceedings connected with the dinner given to Earl Grey, at Edinburgh, on Monday, the 15th September, 1834, and a corrected report of the speeches*, (Edinburgh, 1834), p. 3.

[612] Ibid., p. vi.

ventilation and acoustics. The *Caledonian Mercury* felt sure that Scotland would not be embarrassed by the 'Grey Pavilion' because Reid,

> with whose felicitous Genius in Acoustics his townsmen are so well acquainted, is one of the Committee; whence they may gather the assurance that the interests of the Ear will be as much studied as those of the Eye in the scheme of this vast and magnificent entertainment.[613]

Reid's appointment did not inspire unanimous confidence however. Although enjoying the air of excitement in the city 'full of visitors', present for the BAAS and the forthcoming banquet, the *Morning Chronicle* expressed concern over the pavilion's utility. It was deemed 'very ill adapted for hearing, and as to ventilation, it seems to have been forgotten that the two thousand persons who will meet together on this great occasion will require an occasional breath of fresh air'.[614] While Reid's work received mixed reviews, his involvement with the Pavilion placed him at the centre of Edinburgh political life at a crucial moment before the formation of the 1835 committee to investigate Parliament's air. Along with several MPs, Brougham once again witnessed Reid practically apply knowledge to space.

The projection of his skills of ventilation and sound communication in 1834 made Reid appear as a trustworthy authority for the 1835 committee. The committee 'examined several witnesses of high scientific reputation' in order to ascertain the 'general principles on which a good system of warming and ventilating Public Buildings depends'.[615] With Benjamin Hawes (1797-1862), MP for Lambeth, acting as chair, the committee was impressed with Reid's projection of a perfectly maintained atmosphere. His system promised to utilise chemical knowledge for the material progress of Parliament, but to secure the committee's support, Reid laboured to build credibility. Reid's perceived success in his classroom and the

---

[613] (Anon.), 'Earl Grey's Visit', *Caledonian Mercury*, (Edinburgh, Scotland), 1 Sep., 1834; Issue 17653; a Scottish architect, Thomas Hamilton had secured a reputation through his designs for the Royal High School and Martyrs Monument, both at Carlton Hill in Edinburgh. He later presented a paper on the 'Grey Pavilion' to the RIBA, see Gavin Stamp, 'Hamilton, Thomas (1784–1858)', *Oxford Dictionary of National Biography*, Oxford University Press, 2004 [http://ezproxy.ouls.ox.ac.uk:2117/view/article/12131, accessed 7 April 2013].

[614] (Anon.), 'Edinburgh – Sept. 13', *The Morning Chronicle*, (London, England), 17 Sep., 1834; Issue 20298.

[615] PP. 1835 (583), p. 3.

attention the Grey Pavilion attracted appeared to add weight to his promises of securing healthy air at Parliament. The classroom demonstrated Reid could deliver effective ventilation while the Pavilion showed that he was prepared to publically trial his work on a grand scale. It was the reputation of these projects which contrasted his evidence so favourably to that of the other men of 'scientific reputation'.

Reid argued that to improve the ventilation of the temporary Parliament, 'a column of heated air' should be introduced that would 'create artificial currents through the buildings'.[616] Clean fresh air could enter the Houses through the floor, and would then exit through the roof, drawn by a powerful source of heat outside the temporary accommodation. Vitiated air was to be removed and replaced by pure air which could be heated or cooled, in relation to external conditions, in a chamber beneath the temporary Houses. To provide 'purity', he recommended taking in air from a height above the damp Westminster atmosphere.[617] In his classroom this system had specifically been implemented to extract the fumes from up to '2,000 experiments performed' each hour. As Reid testified, it had performed well: 'I find it absolutely essential to have a power of carrying off those fumes, a power which is perfectly under control, and which can be made to operate to any extent, according to circumstances.'[618] If Reid's system could ventilate a fume-ridden laboratory, accommodating three-hundred students, then by calculating the ideal amount of air an individual should be provided with, in a given time, and then identifying how many people were in attendance, the space of Parliament could come under the control of chemical knowledge.[619]

Reid explained that his ventilation apparatus could secure an atmosphere rich in oxygen and free of carbonic acid. By commanding the laws of nature inside Parliament, improvement could be attained. Efficiency of ventilation would ensure that,

> the atmosphere would never be of that oppressive character which often increases to such an extent in some buildings, where the respired air is not so easily carried away, as to produce a very powerful sedative effect, often accompanied by severe headache, more

[616] Ibid., p. 34.

[617] Ibid., p. 35.

[618] Ibid., p. 34.

[619] Ibid., p. 37.

> especially when it is necessary to maintain a continued and anxious attention to any subject under discussion.[620]

Controlling the atmosphere of Parliament with a powerful ventilation system promised to increase MPs' attention to public business.

What Reid delivered to the committee was a promise of control, precision, and power, but also a demonstration of how chemistry had practical applications beyond the laboratory. He believed that because of this, effectively everyone was a 'practical chemist'.[621] Reid's evidence was a claim that the practice of ventilating Parliament should be a chemical one. He asserted that his understanding of how air moved and what it consisted of, was knowledge acquired through chemical experiments. As ventilation created a change in an atmosphere's chemical state, Reid deemed it a chemical action.[622] He concluded that any 'change of properties … is the grand and leading character of the operations of Chemistry, not a change of motion, place, or figure, as in Natural Philosophy'.[623] The power to effect efficient air purification was therefore chemical action.[624]

Reid's performance before the committee secured him a reputation as someone who could be trusted with improving Parliament's air. His views were of a 'clear, decided and satisfactory nature', while the committee 'saw at once that he spoke as a man thoroughly conversant with the subject'.[625] His proposed system impressed the inquiry, consisting of Hawes, Charles Hanbury-Tracy, Earl Grey, Lord Granville Somerset, Lord Sandon, George Clerk, and Henry Warburton. While Lord Somerset, First Commissioner for Woods and Forests until April 1835, and Hanbury-Tracy had experience of architecture, Warburton and Hawes added medical and scientific authority to the investigations. Warburton had supported Brougham in the founding of London University, and had chaired a parliamentary committee on the study

---

[620] Ibid., p. 39.

[621] David Boswell Reid, *Rudiments of Chemistry; with illustrations of the chemical phenomena of daily life*, 4th ed., (London, 1851), p. iii.

[622] Ibid., p. 6.

[623] Ibid., p. 7.

[624] Reid, 'The study of chemistry', p. 5.

[625] Reid, *Memoir*, pp. 14-5.

of anatomy in 1828.[626] However it was Hawes, the Chairman, who brought the most experience of engineering to the committee. In 1820 Hawes had married Sophia MacNamara Brunel, the daughter of Marc Isambard Brunel. A soap-boiler by trade, Hawes was an enthusiastic supporter of several projects of his brother-in-law, Isambard Kingdom Brunel.[627] Both Hawes and Warburton later worked on the committee for Marc Brunel's Thames Tunnel project, where they pursued a line of questioning regarding the excavation's ventilation.[628] Interestingly, Marc Brunel had been a supporter of Reid's work since visiting the Edinburgh classroom. He believed that Reid's scientific principles displayed at Edinburgh would be ideal for the accommodation of Parliament.[629]

The committee included individuals, like Earl Grey, who had witnessed, or had friends who had witnessed, Reid's science. As Hawes explained, although witnesses Faraday and William Thomas Brande (1788-1866), both servants of the Royal Institution, 'combined practical and scientific value', the committee found no one else displayed such understanding of 'the science and the practice of Ventilation in large buildings'.[630] In comparison to Reid's evidence, none of the other witnesses produced such a trustworthy solution to the problem of parliamentary ventilation. The first, George Birkbeck (1776-1841), was a life-long friend of Brougham, and had inaugurated the London Mechanics' Institute, as well as conducted work for the SDUK.[631] Birkbeck presented the committee with a very damning review of the state of national architecture in terms of ventilation. Due 'to the want of practical knowledge on the subject', he could not recall a single architectural example that employed reliable ventilation. Birkbeck suggested that through 'strict calculation' of how many would sit in a building and 'what impression they will make upon the

---

[626] H. C. G. Matthew, 'Warburton, Henry (1784–1858)', *Oxford Dictionary of National Biography*, Oxford University Press, 2004; online edn, May 2009 [http://ezproxy.ouls.ox.ac.uk:2117/view/article/28672, accessed 8 April 2013].

[627] Ged Martin, 'Hawes, Sir Benjamin (1797–1862)', *Oxford Dictionary of National Biography*, Oxford University Press, 2004; online edn, May 2009 [http://ezproxy.ouls.ox.ac.uk:2117/view/article/12643, accessed 5 April 2013].

[628] *Report from the Select Committee on the Thames Tunnel; with the minutes of evidence,* PP. 1837 (499), p. 11.

[629] David Boswell Reid, *Testimonials regarding Dr D.B. Reid's qualifications as a lecturer on chemistry and teacher of practical chemistry, April 1837*, (London, 1837), p. 10.

[630] Reid, *Professorship of chemistry in the University of Edinburgh*, p. 6.

[631] Matthew Lee, 'Birkbeck, George (1776–1841)', *Oxford Dictionary of National Biography*, Oxford University Press, 2004 [http://ezproxy.ouls.ox.ac.uk:2117/view/article/2454, accessed 7 April 2013].

atmosphere', it might be deduced how to bring about effective air purification.[632] With reference to Lavoisier's experiments on air in Parisian theatres, Birkbeck confirmed Reid's assertion that ventilation was a problem of chemistry, rather than architecture or mechanical engineering. A poorly ventilated crowded room would create a high temperature, a considerable deprivation of oxygen gas, and a drastic expanse of carbonic acid gas. Birkbeck explained how Lavoisier had found that poorly ventilated theatres became 'charged with azotic gas' and carbonic acid: both detrimental to health.[633] Yet Birkbeck lacked Reid's experience of the practical application of such chemical knowledge. He could not recommend a 'good system' to improve the temporary buildings. Considering Parliament's atmosphere, Birkbeck 'for one would not endure it for the service of the public'.[634]

The second witness, John Sylvester, claimed that he had produced a reputable system of ventilation at the Kent Lunatic Asylum. As early as 1819, Sylvester's father, Charles, had published a work considering ventilation in which he argued that natural philosophy, if it were really to improve mankind's state, should be directed to domestic comfort.[635] John Sylvester, continuing his father's work, proposed a system at Parliament based on his asylum near Maidstone, which included a large tunnel under the chambers in which air could be warmed if desired. Nevertheless his system lacked the credibility of Reid's. After a vague explanation of how he controlled the temperature in the asylum, he stated he was not prepared to outline how his system might be adapted for Parliament.[636] After much questioning, Sylvester revealed that his control of the temperature at the asylum required at least fifteen minutes to respond to commands.[637] Later, when Faraday was interviewed, the committee asked about the suitability of Sylvester's scheme. Faraday warned that the whole system would introduce dry 'unpleasant' air into the chambers.[638] Sylvester thus appeared to lack the practical experience which Reid had demonstrated in Edinburgh. Apart from Reid,

---

[632] PP. 1835 (583), p. 5.

[633] Ibid., p. 7.

[634] Ibid., p. 11; Antoine Lavoisier (1743-1794) had, along with producing an early substantial list of elements, identified oxygen and hydrogen.

[635] Charles Sylvester, *The philosophy of domestic economy*, (Nottingham, 1819), pp. x and 1.

[636] PP. 1835 (583), p. 17.

[637] Ibid., p. 16.

[638] Ibid., p. 23.

two other 'eminent' men of science were called to the committee after Sylvester. Brande reported on his experiments on the air in the Covent Garden Theatre, which he recorded as having three per cent carbonic acid by volume during performances in front of a full house.[639] Brande's early career had been prodigious, being elected a fellow of the Royal Society aged twenty-one, and in 1813 replacing Humphry Davy as Professor of Chemistry at the Royal Institution, where he lectured until 1848.[640] However, like Birkbeck and Sylvester, he did not offer a convincing system, and advised the committee to 'be guided by practice rather than theory'.[641]

Before interviewing Brande, the committee invited Faraday to present evidence. He reported on the scientific principles on which his Royal Institution lecture-room was based. Yet Faraday's lecture-room contrasted poorly to Reid's classroom. He warned that,

> no arrangement of the present air passages, or the present mode of heating, has enabled us to give that free and proper draught through the room which shall sufficiently move away bad air and give good without violent partial currents.[642]

Faraday's experience of ventilation was in this way framed with caution. Faraday warmed air beneath the lecture-room, allowed it to flow into the room, and then regulated its exit with a valve placed above in the roof. As Faraday observed, this was sufficient for the Institution, but was unsuitable for Britain's Parliament, where members 'ought to have the full command of temperature without depending on the admission of a given quantity of air'.[643] Faraday defined the chemical problem that any ventilation system should overcome to be deemed successful. He calculated that a man 'destroys about a gallon of air per minute', so a supply of ten to twenty times that amount was desirable.[644] As to the question of how to

---

[639] Ibid., p. 31.

[640] Frank A. J. L. James, 'Brande, William Thomas (1788–1866)', *Oxford Dictionary of National Biography*, Oxford University Press, 2004 [http://ezproxy.ouls.ox.ac.uk:2117/view/article/3258, accessed 7 April 2013].

[641] PP. 1835 (583), p. 27.

[642] Ibid., p. 20; with his brother Robert Faraday, Michael Faraday later worked to ventilate lighthouses, see Frank A. J. L. James, '"the civil-engineer's talent": Michael Faraday, science, engineering and the English lighthouse service, 1836-1865', *Transactions of the Newcomen Society*, 70 (1998-99), pp. 153-60, 155.

[643] PP. 1835 (583), p. 26.

[644] Ibid., p. 22.

introduce this supply, 'experiments are required … we want some numerical data, something more than general impressions or mere opinions'.[645] He reckoned that experiment could provide trustworthy, measurable, evidence.

The committee's witnesses collectively identified the problem of Parliament's atmosphere to be chemical. They agreed that to improve Parliament's air, a system should be built that would ensure its atmosphere was kept oxygen rich, while levels of carbonic acid were minimized. Faraday outlined the importance of finding a trustworthy man of science to direct Parliament's air purification, believing

> that ventilation and warming are so important with regard to an assembly of such a nature, that a full and efficient system ought to be adopted … [delivered by] a man of judgement and observation, uniting some knowledge of architecture and construction with an acquaintance with natural principles.[646]

Considering Reid's evidence and work in Edinburgh to be impressive, the committee felt the chemist was just such a man of judgement. They recommended to Parliament that,

> the alterations suggested by Dr Reid should, if practicable, be submitted to the test of actual experiment during the ensuing recess, as the only means of ascertaining with accuracy the soundness of the principles laid down in the Evidence, and their useful application to the future Houses of Parliament.[647]

This conclusion went further than simply declaring Reid's evidence credible, but explicitly demonstrated that he had convinced the committee to sanction experiments to validate his work in Edinburgh. This decision to allow Reid to prove his evidence through experiment paralleled the scientific method he developed in Edinburgh. Following Reid's death in 1863, his brother asserted that his career had been built on the strength of his competence at using experiments as demonstrations. It was not only that Reid's lectures were lucid, but that his experimental displays usually fulfilled his predications in front of audiences.

---

[645] Ibid., p. 25.

[646] Ibid., pp. 23-4.

[647] Ibid., p. 4.

The extent of Reid's preparation and knowledge meant that he 'was seldom if ever placed in the awkward position of failing in an experiment – of telling his class that such a change would take place, while the inert materials defied him, and refused to exhibit the predicted phenomenon'.[648] Therefore the strength of Reid's public experiments was that the results of his chemical manipulations realized his predictions. His approach was to show he knew an experiment's results before its completion. In asking Reid to validate the evidence he presented to the committee, what was requested was the performance of this experimental method on a large scale. The challenge would be to fulfil promises made from evidence collected in Edinburgh, at Westminster. The process of experimentally demonstrating predicted phenomena was synonymous with Reid's series of classes. Reid was subsequently appointed to improve the atmosphere of Parliament, and to conduct experiments at Westminster which might confirm the 'soundness of the principles' of his earlier endeavours.

Edinburgh science at Westminster: Parliament as a laboratory

Although Reid's proposed system impressed Hawes' committee, he was not immediately entrusted with the ventilation of Barry's new permanent building. His appointment to experiment in the temporary accommodation provided an opportunity to deliver his Edinburgh classroom system at Westminster, but securing trust in London was hard. In Smirke's temporary Commons, Reid introduced an up-cast shaft system of ventilation. Exiting via a specially built chimney, air was drawn through the House from the floor and out through the roof. **(Fig. 16)** Heat was created at the base of the chimney by a twenty-five horse-power steam-engine which controlled the current through the House.[649] Incoming air was first filtered, and then heated in a chamber beneath the House.[650] The speed of the current was controlled by a single valve regulating the exit of air into the roof and down towards the furnace. Reid introduced a lower ceiling, of the same shape as that in his classroom to assist the air flow and acoustics of the room. In October 1836, *The Times* confidently reported that the interior had been completely 'remodelled, and

[648] Hugo Reid, *Memoir*, p. 12.

[649] Denis Smith, 'The Building Services', in Port (ed.), *The Houses of Parliament*, pp. 218-31, 220.

[650] Sturrock and Lawson-Smith, 'The Grandfather of Air-Conditioning', pp. 2984-5.

rendered in every particular more convenient and eligible for its purposes. The ventilation of the House will be much improved, by preserving an equal temperature without the sudden gusts of cold air'.[651] Yet while Reid's alterations appeared improving, the nature of his work, as the 1835 committee directed, was experimental. The committee expected Reid to advance knowledge in the scientific principles of ventilation. Reid worked to transform the political space into a site of chemical knowledge production.

When the committee examined Smirke about the practicality of Reid's alterations, they proposed experiment, in the form of repeated testing of the composition of the atmosphere both when under Reid's control, and without the aid of ventilation. Reid convinced the committee that the Commons, like his classroom, could be treated as an experimental space. The committee wanted 'to try the experiment, considering that a new House is to be built, and that something in the way of experiment should be tried previously'.[652] Smirke was requested to 'give a fair trial to the principles upon which Dr. Reid has founded his plan'. Smirke did not share this confidence in transforming what he perceived to be a functioning legislature into a chamber of experiment. He agreed to follow Reid's directions, provided that it was the chemist who accepted sole responsibility for the system. Smirke preferred the construction of a smaller room to experiment on first, being 'very much afraid of trying so hazardous an experiment upon such a room' as the House of Commons.[653] To alter a building, or adapt architectural plans to provide effective ventilation was untried and dangerous. Smirke warned that 'Should the experiment fail … from any difficulties in the application of the principle … the inconvenience … during the session of Parliament, would be very serious'.[654] When Reid was recalled, he suggested that a small laboratory may be erected to obtain information regarding ventilation, by 'actual experiment'.[655] Such 'a model of the new House of Commons' would provide knowledge to guide the construction of the permanent building. Reid offered

[651] (Anon.), 'Workman have been actively engaged…', *The Times*, (London, England) 20 Oct., 1836; Issue 16239, p. 3.
[652] PP. 1835 (583), p. 52.
[653] Ibid., p. 53.
[654] Ibid., pp. 52-3.
[655] Ibid., p. 55.

to do this work in Edinburgh, for the sum of £2,000. He advised that with an additional £1,000, he could convert this experimental model into a church after the experiments were complete.[656]

Using a model chamber, built in his Edinburgh classroom, and the temporary Commons, chemical knowledge would be acquired through experiment, which would be used in reference to the new permanent Parliament.[657] Experiments would consist of air-testing the atmosphere in the Commons when subjected to ventilation. In the Commons, Reid developed a device for testing and regulating the purity of the atmosphere. The 'carbonometer', which he likened to a thermometer of purity, consisted of lime water in a phial through which air was passed to test for carbonic acid levels.[658] **(Fig. 17)** Such apparatus would allow for the examination of the atmosphere and provide comparable evidence. Meat also provided an instrument for testing air. Reid found that in the area around Parliament, meat ten to twenty feet off the ground went bad within twenty-four hours, yet meat suspended thirty to forty feet remained fresh for as long as three days.[659]

As in Edinburgh, Reid claimed authority by displaying his work to public audiences. These spectacles were experimental, but they were also about wider issues of credibility. In November 1836 he invited a press delegation, along with Hawes and several gentlemen of 'literature and science', to witness a demonstration of the power of his system. *The Times* reported this display in detail. Reid filled the House with 540 guests, including 412 off-duty foot-guards marched down from local barracks. This provided an environment similar to that encountered in the House when full. Reid explained how the air moved into the house via one-sixth of an inch perforations in the ancient floor, totalling 'the almost incredible number of 350,000'. To 'pump out' the vitiated air through the ceiling, 'an exceedingly large coal-fire' at the base of the chimney erected in the Cotton-garden provided the desired power. This source of heat affected a

---

[656] Ibid., p. 56; on the shortage of Presbyterian Church space and the post-1823 building programme, see Allan Maclean, *Telford's Highland Churches: the highland churches and manses of Thomas Telford*, (Inverness, 1989).

[657] Schoenefeldt, 'The temporary Houses of Parliament', p. 178.

[658] Reid, *Illustrations*, pp. 65-6.

[659] *Report from Select Committee on Ventilation of the New Houses of Parliament; with the minutes of evidence, and appendix,* PP. 1841 (51), p. 13.

'rapid withdrawal of the air within the house and substitution of fresh air for foul'.[660] Showing the power he had at his command,

> Dr Reid then proceeded to try the following experiments, with a view to show the rapidity of circulation through the house:- He first caused the introduction of a smoke so dense that it was impossible to see five yards forwards. In about one minute and a half, by the action of the shaft, it was entirely expelled. He next introduced the odour of ether, which was strongly perceptible to every person present, and dispersed in an equally short space of time by the active but imperceptible introduction of heated air. In like manner was the scent of oranges raised and dispersed.[661]

This exhibition transformed the locus of government into a spectacle of science. To be able to apparently introduce and evacuate atmospheric elements at will demonstrated precision and control. *The Times* noted the lecture-room-like quality of the House of Commons under Reid's direction. **(Fig. 18)** Throughout the demonstration, Reid had exhibited,

> by means of a glass model on the table of the house, the operation of his plans, in order to render the experiments subsequently made in the House itself more comprehensible to his numerous auditory. During the experiments which followed, the learned gentleman, in an able manner, and at considerable length, delivered what may be termed a lecture on ventilation.[662]

Not only did Reid show off the power of his system, but he detailed how his practice at Westminster advanced scientific learning and established his credibility as a result.

The findings of Reid's experiments were published in his 1844 *Illustrations of the theory and practice of ventilation*. This text, although including much evidence collected beyond the walls of Parliament, was the

---

[660] (Anon.), 'The alterations in the House of Commons', *The Times*, (London, England) 5 Nov., 1836; Issue 16253, p. 3.

[661] Ibid..

[662] Ibid..

printed embodiment of Reid's work at Parliament. Its findings were presented to guide public building in accordance with the natural laws of atmospheric composition and respiration. In this publication, Reid called for 'mechanical power' to deliver the amount of air each individual required and for 'each building to be ventilated having been treated as a piece of apparatus … absolute power obtained over the ingress and egress of air'.[663] This work was to 'contribute to assist the Architect in designing – the Physician in practising – and others in regulating the atmosphere in which they live, in unison with the principles of ventilation'.[664]

Reid defined his work as that of a 'Professional Chemist', involving 'Chemistry of the Atmosphere; of Respiration and Transpiration; of Combustion … and the regulation and control of an external atmosphere, ever changing in its natural qualities'.[665] Reid outlined the threats of carbonic acid, sulphureted hydrogen, sulphurous acid, hydrochloric acid, ammonia, and other air impurities. These he had tested at Parliament. Local manufacturing had reduced the quality of the Westminster atmosphere; Reid had found arsenic, copper, and lead impurities through his experiments. Reid's evidence was very much an answer to local conditions; he complained of the smell of the local gas works and 'barges laden with manure' passing on the River Thames.[666] **(Fig. 19)** Yet the knowledge produced and the solutions provided at Parliament could, Reid asserted, be replicated. Indeed the same practices which had secured the health of Edinburgh students appeared to have been transferred to Westminster's unhealthy atmosphere.

Building trust at Westminster was an altogether different challenge. Not only did Westminster provide a considerably larger audience than his Edinburgh classroom, but MPs proved difficult subjects to satisfy. This question of subject was one prominent in Victorian society. The question of who it was that was experimented on mattered. Alison Winter notes that when humans became instruments in experiments, the main problem was how to make their accounts seem reliable. She shows that this was often achieved by portraying human subjects to lack education or apparent freedoms; human accounts

---

[663] Reid, *Illustrations*, p. viii.

[664] Ibid., p. xv.

[665] Reid, *Professorship of chemistry in the University of Edinburgh*, p. iv.

[666] Reid, *Illustrations*, p. 298.

seemed most reliable when the subjects appeared like unthinking machines.[667] *The Times* observed that MPs would provide a sterner test than the rows of silent foot-guards under 'strict obedience to the word of command', and joked that 'a more orderly house' had never been seen before.[668] While atmospheres and foot-guards might be controlled, honourable members did not make such compliant subjects.

Just a year after the experimental displays to *The Times*, Thomas Wakley (1795-1862), the Devonian MP for Finsbury, raised concerns in the Commons over the health of members. He believed that ventilation still demanded 'serious consideration', and asked other members if they too had not 'suffered from irritation of the throat and lungs'.[669] Wakley had examined the House with Arnott, who recommended air descend rather than rise through the house, along with a constantly wet cloth suspended above the seating. This introduction of increased moisture, Arnott and Wakley claimed, would reduce the dust inhaled by members.[670] Despite Reid publically responding to such criticism, groups within the Commons remained dissatisfied with the system.[671] Members reiterated their objection to Reid's method of drawing air up from the floor. Wakley was particularly concerned following his consultancy with Arnott. Arnott had much praise for Reid, believing the Commons to be 'the only instance in existence of effectual ventilation for such a place'.[672] Nevertheless he expressed concern at the up-cast system in place due to the atmospheric dust created. Although raised a Roman-Catholic, Arnott was a prominent member of London Benthamite circles and had introduced Edwin Chadwick to Jeremy Bentham. Arnott was a keen disseminator of the Chadwickian miasmatic theory of disease, maintaining that filth and odour were causes of poor health.[673] In Wakley he found a willing audience for his concerns over the air of Parliament. Wakley

---

667 Winter, *Mesmerized*, p. 62.

668 (Anon.), 'The alterations in the House of Commons', *The Times*, (London, England) 5 Nov., 1836; Issue 16253, p. 3.

669 (Anon.), 'House of Commons', *The Times*, (London, England) 25 Dec., 1837; Issue 16608, p. 3.

670 Ibid..

671 *Ventilation of the House. Copy of a letter from Dr. Reid to Lord Duncannon, dated February 4th, 1837, relative to the acoustic and ventilating arrangements lately made in the House of Commons,* PP. 1837 (21), p. 1.

672 Neil Arnott, *On warming and ventilating: with directions for making and using the thermometer-stove, or self-regulating fire, and other new apparatus*, (London, 1838), p. 86.

673 Bill Luckin, 'Arnott, Neil (1788–1874)', *Oxford Dictionary of National Biography*, Oxford University Press, 2004 [http://ezproxy.ouls.ox.ac.uk:2117/view/article/694, accessed 7 April 2013].

himself had earned a reputation in medicine as the founder and editor of the medical journal *The Lancet* (1823). He campaigned for medical reform, drafting various medical acts throughout the 1830s and 1840s alongside Warburton.[674] Together the medical concerns of Wakley and Arnott represented a serious challenge to Reid's system.

Concerned MPs chose Sir Frederick William Trench (c.1777-1859), MP for Scarborough, to voice this lack of confidence in Reid's system. He argued that Reid's work was 'admirable', but that the House remained devoid of a system that incorporated safe ventilation and sufficient lighting. Trench was a self-proclaimed authority on architecture.[675] He proposed what he felt was a distinctly non-scientific solution to the problem of dust, in which the hair-cloth carpet covering the floor would be lifted, and the floor oiled, before replacing the covering.[676] This cheap 'experiment' would create 'a constant flow of the improved Wakley and Arnott air, without a particle of dust'. Trench portrayed this plan as common-sense, rather than scientific. There was 'nothing of philosophical science to recommend it'.[677]

Reid defended his system by explaining that the dust was not due to the up-cast current, but to the incompetence of the 'cleaning department'. The carpet did accumulate dust, but Reid's instructions for it to be lifted and beaten daily had been ignored.[678] He maintained that without 'proportionate care in the cleaning department … it is impossible that any system of ventilation can give satisfaction'.[679] Reid nevertheless revealed that he wanted to convert to down-cast ventilation following experiments in his Westminster laboratory. This would draw in air through the roof of the Commons before evacuating it through the floor, therefore reducing the chance of dust from the carpet contaminating the room's atmosphere. Trench rejected the possibility of a down-cast system, believing it would ruin the chamber's

---

[674] W. F. Bynum, 'Wakley, Thomas (1795–1862)', *Oxford Dictionary of National Biography*, Oxford University Press, 2004 [http://ezproxy.ouls.ox.ac.uk:2117/view/article/28425, accessed 5 April 2013].

[675] M. H. Port, 'Trench, Sir Frederick William (*c.*1777–1859)', *Oxford Dictionary of National Biography*, Oxford University Press, 2004 [http://ezproxy.ouls.ox.ac.uk:2117/view/article/27699, accessed 5 April 2013].

[676] *Ventilation of the House. Copy of a letter from Sir Frederick Trench to Lord Viscount Duncannon, on the subject of ventilating the House of Commons, with Lord Duncannon's answer*, PP. 1837-38 (204), p. 2.

[677] Ibid., p. 2.

[678] *Ventilation of the House. Copy of a letter from Dr. Reid to the Viscount Duncannon, in reply to observations addressed to His Lordship by Sir Frederick Trench*, PP. 1837-38 (277), p. 1.

[679] Ibid., p. 5.

candle lighting. He felt Reid's blaming of the cleaning department was a poor attempt to show the faults were 'not from any error in his science'.[680] Even if the 'housemaids' made the carpet 'as clean as Her Majesty's toilet table', dust would still be a problem. As Trench put it, 'common sense (*versus* philosophy and science)' suggested dirt would be continually carried in on the shoes of members.[681] Trench also rejected the suitability of having Reid administer the system from Edinburgh. Someone 'resident in London' would be preferable to the constant expense of having Reid travelling down to monitor the ventilation.[682] **(Map A)**

Rather than reply, Reid arranged a series of demonstrations to quiet the complaints, continuing to believe that the best way to build credibility was through performance. Several members of the press were invited to witness Reid's new descending system of ventilation, combined with experimental gas lighting. Filling the Commons benches with men armed with buckets of water should a fire break out, the gas lighting was kept separate from the Commons atmosphere. With air exiting via the floor and the combusted gas 'effluvium being prevented from descending', the system had been adapted to meet the concerns of Wakley, Arnott, and Trench.[683] Trench was invited at a later date, 'to see his experiment of the effect of the descending current'.[684] Trench admitted that he had 'been mistaken'. He considered Reid's system was an effective way of placing the Commons' atmosphere under the regulation of a furnace. Trench described how he saw,

> four experiments tried: three different odours, orange, lavender, and cinnamon, were in succession distributed rapidly and effectually over the whole body of the House, and carried through the hair-carpet and the perforated floor into the apartment below, where

---

[680] *Ventilation and lighting of the House. Letters from Sir Frederick Trench to Lord Duncannon, on the subject of ventilation and lighting the House of Commons*, PP. 1837-38 (358), p. 2.

[681] Ibid., p. 2.

[682] Reid's expenses for the Westminster experiments totalled over £512, see *Ventilation of the House. Return of the detailed expenses incurred in experiments for improving the ventilation, &c. of the House of Commons, in the experiment of lighting with gas, also in lighting with candles, ending with the present lustres and shades*, PP. 1837-38 (725), p. 1.

[683] (Anon.), 'Domestic Notices', *The Architectural Magazine*, Vol. V, (London, 1838), p. 87.

[684] *Ventilation and lighting of the House. Letters from Sir Frederick Trench to Lord Duncannon, on the subject of ventilation and lighting the House of Commons*, PP. 1837-38 (358), p. 5.

> a gale of wind hurried them off to feed the furnace which created this current. Gunpowder was then exploded between the roofs; the smoke instantly pervaded the whole of the House, and was seen descending regularly till it was drawn through the hair-carpet into the regions below.[685]

Through witnessing Reid's power, Trench was 'now convinced of the truth'. He agreed that Reid's solution was sufficient for the parliamentary atmosphere. Successfully managing an experimental spectacle proved a powerful resource for building credibility, even with sceptical audiences.

Reid's system of ventilation was but one scheme in a series of projects in which he laboured to secure his chemistry recognition of its usefulness. Reid implemented a complex system of ventilation on the three ships comprising the ill-fated Niger Expedition of 1841. **(Fig. 20)** Initiated during an inaugural address by Prince Albert at the 1840 meeting of the Society for the Extinction of the Slave Trade and for the Civilization of Africa, held in Exeter Hall, this project was intended to carry Christianity into Africa and eradicate the evils of slavery.[686] Crucially, an aim of this society was to demonstrate to the African continent that British medical science could tame the tropical miasmas of Africa's coasts and fever ridden river areas. Christian science was to be exhibited as a great tool of 'civilization'.[687]

Appreciating Reid's experimental work at Parliament, the MP Benjamin Smith invited Reid to replicate his methods of ventilation on-board the expedition vessels.[688] He devised a system whereby tubes for the ingress and egress of air ran through each ship, and air was drawn in through filters using the rotation of fans connected to the paddle-wheels of the ships.[689] What this was, as Reid informed the BAAS at the

---

[685] Ibid., p. 5.

[686] (Anon.), 'Address on behalf of Africa', *The Friend of Africa*, Vol. 1, No. 1 (London, England), 1 Jan., 1841, p. 5; on the expedition, see Howard Temperley, *White Dreams, Black Africa: the antislavery expedition to the River Niger, 1841-1842*, (New Haven, 1991).

[687] (Anon.), 'Advantages of medical science to Africa', *The Friend of Africa*, Vol. 1, No. 2 (London, England), 15 Jan., 1841, p. 17; see Stewart J. Brown, *Providence and Empire: religion, politics and society in the United Kingdom, 1815-1914*, (Harlow, 2008), pp. 139-43.

[688] David Boswell Reid, 'Dr Reid on the ventilation of the Niger steam vessels', *The Friend of Africa*, Vol. 1, No. 4, (London, England), 1 Feb., 1841, p. 43.

[689] Ibid., pp. 44-5.

Plymouth meeting of 1841, was a showcase that the practices developed in Parliament could be replicated beyond Westminster and carried over space to bring order, control, and improved health to the most far flung corners of the world.[690] This system of ventilation was to 'illustrate the importance of a knowledge of practical chemistry being acquired generally by those who may have to visit a distant country', and also those at home.[691] At Westminster, Reid worked to perfect techniques that he believed could carry civilization beyond Britain. If buildings could be conceptualized as air-pumps, then so too could ships.

Giving an account of Reid's work, Elisha Harris explained how demonstrations at Westminster and on the Niger had ramifications for all society. Reid's promotion of health through ventilation displayed 'the soundest principles of political economy and the precepts of Christian duty'.[692] Ventilating the homes of the poor furnished the 'most reliable indices of the state of intellectual and moral advancement in any community', and its improvement was a means of 'moral elevation'.[693] At Parliament then, Reid claimed to do more than secure the legislature's health, but demonstrate how to induce material improvement. Parliament was foremost a work of architecture, but architecture was itself 'an art upon which the principles of vital chemistry … have claims'.[694] Chemistry, alongside architecture, was to be applied to Parliament and the 'wants of common life'. Reid explained that ventilation was a 'new power' and product of 'modern times'. When done with 'proper experimental illustrations', chemically informed ventilation was an advancing science.[695]

---

690 (Anon.), 'Arts and Sciences. British Association', *The Literary Gazette and Journal of Belles Lettres, Arts, Sciences, &c.* (London, England), 28 Aug., 1841, pp. 561-3; for an account of Reid's ventilation system, see James Ormiston M'William, *Medical history of the expedition to the Niger during the years 1841-2 comprising an account of the Fever which led to its abrupt termination*, (London, 1843).

691 David Boswell Reid, 'Dr Reid on the ventilation of the Niger steam ships.', *The Friend of Africa*, Vol. 1, No. 5 (London, England), 24 Mar., 1841, p. 70.

692 Elisha Harris, 'An introductory outline of the progress of improvement in ventilation', in David Boswell Reid, *Ventilation in American Dwellings; with a series of diagrams, presenting examples in different classes of habitations*, (New York, 1858), pp. iii-xxxv, iv.

693 Ibid., p. iii.

694 Ibid., p. xvii.

695 Reid, *Ventilation in American Dwellings*, pp. 4-5.

Securing support for his ventilation was difficult beyond Westminster, especially with national scientific audiences, like those of the BAAS. Although missing the inaugural BAAS meeting at York in 1831, Reid shared in the sentiments of the association and hoped 'that a permanent society will be established'.[696] Reid became an active attendant of meetings, exhibiting his Edinburgh laboratory in 1834, and giving papers in Dublin (1835), Newcastle (1838), Birmingham (1839), and Plymouth (1841). At Newcastle he delivered a paper to the medical section of the association 'On the Amount of Air Required for Respiration', which contained the results of his experiments on respiration performed in the Commons. He explained how 'precise experiments' within Parliament had proven that the minimum supply of air in a crowded public building should be 'thirty cubic feet for each individual' per minute. He also suggested 'methods of filtering the air of its impurities when desired.[697] At Plymouth, however, speaking on the ventilation of ships, Reid aroused not praise, but scepticism over the utility of his apparatus. Reid presented at Devonport alongside papers from Marc Brunel on his Thames Tunnel project, and watchmaker Edward John Dent on recent improvements to chronometers. Despite appearing alongside such eminent authorities, the Section E audience received Reid poorly, with one reviewer describing how in his paper, Reid had taken up 'so much space in opening the *valves* … that he left himself no time for its sufficient *winding* up'.[698]

Despite these questions surrounding Reid's work, there was a consensus that he had improved Parliament's atmosphere. Thomas Graham (1805-1869), the Professor of Chemistry at London University College, felt the 'magnificent experiment' to be 'one of the grandest applications of physical science that has lately been attempted'.[699] Physician to the Queen and Prince Albert, James Clark, believed the work

---

[696] Bodleian Library, Oxford (BOD) Ms Dep. Papers of the British Association for the Advancement of Science, 1, Correspondence of John Phillips, Folios 134-5, 'Letter from David Boswell Reid to John Robison', (20 Sep., 1831).

[697] 'Notices and abstracts of communications to the British Association for the Advancement of Science', in *Report of the eighth meeting of the British Association for the Advancement of Science; held at Newcastle in August 1838*, (London, 1839), pp. 131-2; also see David Kennedy, 'Dr. D. B. Reid and the Teaching of Chemistry', *Studies: An Irish Quarterly Review*, Vol. 31, No. 123, (Sep., 1942), pp. 343-50.

[698] (Anon.), 'Arts and Sciences. British Association', *The Literary Gazette and Journal of Belles Lettres, Arts, Sciences, &c.*, 28 Aug., 1841, No. 1284, (London, England), p. 563; also see Morrell and Thackray, *Gentlemen of Science*, p. 265.

[699] Reid, *Professorship of chemistry in the University of Edinburgh*, p. 1.

would 'do more to improve the public health than any measure with which I am acquainted'.[700] Physician John Forbes believed Reid, 'in the laboratory provided for him by Government in the Houses of Parliament', had progressed practical scientific knowledge of ventilation in public buildings.[701] Crucially Reid also found support from Edinburgh natural philosopher David Brewster, as well as T. Lloyd, the chief engineer of the Royal Dock-Yard at Woolwich, Alexander Milne, Commissioner of Her Majesty's Woods and Forests, the Duke of Sutherland, and the Canon of Westminster, John Jennings.[702] Furthermore, Lord Campbell, of the 1834 BAAS delegation, believed that in the Commons 'the temperature is regulated by the thermometer with the most complete accuracy and steadiness; and the air is at all times as pure as that breathed on Hampstead Heath'.[703]

Hanbury-Tracy, now Lord Sudeley, shared Campbell's enthusiasm for Reid's apparatus. He recalled how the,

> pestilential atmosphere of the House of Commons was notorious; its baneful effects on the healths and energies of its members were painfully felt and admitted … and the most sanguine never dreamt that it could be cured, much less that the ventilation of the Houses could be brought to such a degree of perfection … To your skill, zeal, and determination it is owing that the members of the House of Commons can now pursue their senatorial duties without a sacrifice of either health or comfort – to you we owe the solution of our problem.[704]

Practical chemistry had effected a material improvement in government and the administration of its duties. Reid had secured enough credibility that his practices and apparatus could be considered suitable to address the atmospheric challenges of the permanent Parliament.

---

[700] Ibid., pp. 4-5.

[701] Ibid., pp. 5 and 7.

[702] Ibid., pp. 29, 25, 10, 12, and 16.

[703] Ibid., p. 9.

[704] Ibid., p. 8.

Knowledge for a Palace

Reid's experiments in the temporary Commons earned him much praise, but the question of ventilating the permanent building was an altogether different challenge. Once Reid had exported his apparatus and practices from Edinburgh to Westminster, he had to transfer his work from the temporary buildings to the new Parliament. This raised two problems. Primarily working on the permanent building involved cooperating with Barry. As shown in Chapters Two and Three, Barry felt himself to be a scientific authority in his own right. With Reid used to exerting complete control, as he had when experimenting in the temporary buildings, cooperation between the two men proved impossible to sustain. The second problem was the nature of Reid's experimental knowledge. Reid's approach in the temporary Commons was to experiment and allow his results to guide the form of ventilation adopted. As his experiments continued, so the system evolved. In temporary accommodation this practice was acceptable, but when Reid attempted to continue this in the permanent building, experimental knowledge appeared inappropriate. Every experiment involved changes to his ventilation plans and as his relationship with Barry broke down, the national press interpreted his experiments as dangerous and unstable. Constant experimenting appeared to produce disordered knowledge. In contrast, Barry referenced men of science, like Faraday, who provided consistent information. In public and private debates, Barry's supporters used this perceived instability to assert that Reid's experiments were inappropriate for a permanent Parliament.

After lobbying Lord Duncannon, Reid secured appointment as the practical engineer to the permanent building in October 1839.[705] Duncannon's choice was initially popular. *The Times* observed that Reid's experiments in the temporary House had been enlightening: he was 'the gentleman who introduced and perfected the system at the Commons'.[706] Duncannon advised Lord Melbourne of the advantage of enticing Reid to leave Edinburgh and work permanently at Westminster, and in November 1839 Melbourne and the Chancellor of the Exchequer agreed to finance Duncannon's request.[707] Ventilating the permanent building required permanent attention, so Reid took accommodation at Duke's Street. The ventilation and

[705] Alexandra Wedgwood, 'The New Palace of Westminster', in Christine Riding and Jacqueline Riding (eds.), *The Houses of Parliament: History, Art, Architecture*, (London, 2000), pp. 113-35, 120.

[706] (Anon.), 'The Houses of Parliament', *The Times* (London, England), 25 Jan., 1841; p. 4; Issue 17576.

[707] Reid, *Narrative*, p. 8.

heating of Parliament was thus placed in Reid's hands, but with a clause that Barry should not agree to anything which would affect the building's architectural character or solidarity. Nevertheless, Duncannon instructed Barry to assist Reid in all matters of a scientific nature.[708]

Reid outlined his proposed ventilation system to an 1841 select committee on ventilating the new building. To create a 'pure atmosphere', Reid explained how his experiments in the temporary House revealed three components to a successful system of ventilation. Firstly, air for Parliament should be taken from a high altitude to avoid impurities. Secondly, it was vital to reserve a large space beneath the building as a 'reservoir' for prepared air. In summer this was to be cooled and in winter heat applied. Finally, to drive this system, a large source of power was desirable.[709] It was proposed that air enter from the Victoria and Clock towers at either end of the Palace, and then be drawn through the building before extraction via a new central tower. This system would sustain a current, constantly driving the air in and out of Parliament. Heat beneath the central tower would assist this 'plenum movement'. The Palace of Westminster was conceived of as an enormous 'tube' through which air would pass, 'modified' along the way 'according to circumstances'.[710] He described how he intended Parliament to operate as a giant air-pump; he wanted to establish 'a constant plenum impulse sustained by natural causes'.[711]

Reid stipulated that the central tower over Barry's central hall would create enough pressure to drive the system without mechanical power. It was to be a structure which created a motive 'power' of ventilation.[712] Vernon Smith, Whig MP for Northampton and member of the committee, was sceptical of these assertions of power, but Reid advised the member to visit his 'experimental room' where empirical evidence as to the efficaciousness of a central shaft could be presented.[713] Throughout his explanation of

---

[708] Ibid., p. 8; also see Moritz Gleich, 'Architect and service architect: the quarrel between Charles Barry and David Boswell Reid.', *Interdisciplinary Science Reviews*, Vol. 37, No. 4 (Dec., 2012), pp. 332-44.

[709] PP. 1841 (51), pp. 7-8.

[710] Ibid., p. 8.

[711] Ibid., p. 24.

[712] Ibid., p. 10.

[713] Ibid., pp. 12 and 31; W. R. Williams, 'Vernon, Robert , first Baron Lyveden (1800–1873)', rev. H. C. G. Matthew,*Oxford Dictionary of National Biography*, Oxford University Press, 2004; online edn, Jan 2008 [http://www.oxforddnb.com/view/article/25898, accessed 25 Feb 2015].

this scheme, Reid consistently emphasized how his method was a product of experiments and observable phenomena. Although he boasted of the power of a central tower, he wanted to have a source of heat available in addition which might be deployed to create additional power during busy sessions in the two debating chambers.[714] Barry agreed to Reid's demand of a tower which would, he believed, improve the architectural character of the building. He recommended a high spire both to aid ventilation and to create 'the most picturesque' appearance alongside the other two towers.[715] This 299 foot octagonal tower, erected over the central lobby between the Commons and Lords, was covered with exquisite external Gothic detail and conceptualized as a giant chimney. **(Fig. 21)** Barry estimated that the cost of construction would be around £20,000, but was cautious over Reid's claims for so much space as an air reservoir beneath the building.[716] It was a remarkable architectural structure in that it was almost completely guided by scientific theory.

Reid's evidence at the select committees of 1842 and 1844, both established to monitor the work on the permanent building, was produced through experiment. The 1842 committee agreed that Reid's experiments should continue.[717] Reid convinced the committee with his experimental evidence based on 'daily observations'.[718] Via experiment, Reid asserted that he was securing ever more power over the atmosphere. His observations confirmed his belief that steam engines should be used to produce heat to draw air through the Palace.[719] At the 1844 select committee he explained that efficient ventilation was essential to an efficient legislature. He believed that some bills, such as the 1832 Reform Bill, required time and diligence to be made effective. What Parliament demanded was a system of ventilation that could facilitate 'any particular bill'. As Reid put it, 'The Power of individual Control, by closing or increasing the Introduction of Air at the particular Benches, I consider will facilitate considerably the public Business of

[714] Explained in, Reid, *Illustrations*, pp. 270-309.

[715] PP. 1841 (51), p. 17.

[716] Ibid., p. 20.

[717] *Report from the select committee on ventilation of the new houses of Parliament; with the minutes of evidence,* PP. 1842 (536), p. 3.

[718] Ibid., p. 5.

[719] Ibid., p. 12.

both Houses'.[720] Reid's ventilation system was about providing a model of chemical practices replicable beyond Westminster, but also enabling effective government.

Reid's early claims to provide scientific ventilation found support both in Parliament, and in the British press. *The Times* agreed that Reid's science was effective and contributed to a modern legislature. Its only regret was that such worthy work was wasted on MPs. While in Parliament Lord John Russell complimented Reid's ventilating 'powers', *The Times* could not 'refrain from saying that the Doctor's abilities seem to have been sadly thrown away upon the Whigs, for truly a worse lighted or a more ill-aired set have never sat in Parliament'.[721] Early on then, the greatest problem facing Parliament was not the standard of its air, but the perceived competence of its members.

Despite such public support, Reid's work increasingly became a subject of discontent with Barry. In June 1844, Reid complained to the select committee assessing the progress of the building of Parliament, of a dispute with Barry regarding the space beneath the two debating chambers. Reid believed the space was best employed as a reservoir in which to condition air before it entered into the Houses of Commons and Lords. Barry was promoting 'different modes' for this space with suggestions of employing it as a store for Parliamentary records, or even as a 'sub-hall' for horses and carriages.[722] Apart from the noise this would create in the Commons, Reid felt that Barry's 'various claims upon the space' would undermine his 'power' of controlling the temperature and humidity of air entering into the Lords and Commons.[723] Reid asserted this space was a 'scientific concern', rather than 'architectural part'.[724] **(Fig. 22)**

There had initially been accord between Barry and Reid but by 1843 disagreement was rife. Barry was unhappy with Reid's continually changing demands over the form of ventilation, while Reid disliked

---

[720] *Brought from the Lords, 9 August 1844. Second Report from the select committee of the House of Lords appointed to inquire into the progress of the building of the Houses of Parliament, and to report thereon to the house; with the minutes of evidence taken before the committee,* PP. 1844 (629), p. 69.

[721] (Anon.), 'Sir Robert Peel', *The Times* (London, England), 18 Sep., 1841; p. 6; Issue 17779.

[722] *Report from the select committee on Houses of Parliament; together with the minutes of evidence taken before them,* PP. 1844 (448), pp. 26-34.

[723] Ibid., pp. 29-30.

[724] Ibid., p. 34.

Barry's persistent architectural alterations.[725] Reid's reliance on experimental evidence to determine the form of his ventilation proposals meant that his demands changed, as the findings of his tests varied. As a result, the knowledge on which Reid was basing his judgement appeared inconsistent and unstable. With obscured lines of authority between architect and chemist, communication disintegrated as each reworked their plans and intentions without reference to each other. Both men made claims over various sections of the building, and proposed different schemes. In the Lords, Reid demanded a high roof for the gallery which he believed would assist the air circulation of the chamber. Barry preferred a low ceiling for aesthetic qualities, and the 'general effect of the building'. To the commissioners of the Office of Woods, Reid promoted this conflict as a question of architecture versus science. They responded by demanding that Barry, in the interests of 'public advantage', respect Reid's 'professional knowledge'.[726]

Another area of dispute erupted over the fire-proofing of the building. Barry's mandate included instructions to employ only incombustible materials in the building's superstructure. Yet Reid's ventilation threatened to create a space throughout the building in which a fire might rapidly spread. When Reid responded angrily to Barry's refusal to prioritize ventilation over fire-proofing, and stormed into Barry's office, Barry had two gentlemen take notes covertly. These included some unspecified offensive comments on Reid's behalf, which Barry had copied and circulated among the Peers and press.[727] Barry later took legal action for slander over these 'strong' expressions, but the court found in Reid's favour.[728] Reid felt that Barry and his engineer, Meeson, had acted in concert to ruin his reputation and had forged the minutes of the meeting regarding the fire-proofing. Reid believed a court was not adequate to value the concerns he had raised, but rather that his efforts should be judged by individuals he considered to be 'men of science'.[729]

---

[725] Reid, *Narrative*, p. 13.

[726] Ibid., pp. 13-14.

[727] Ibid., p. 15.

[728] Hugo Reid, *Memoir*, p. 22; on the trial, see (Anon.), 'Court of Common Pleas. – July 6', *John Bull*, (London, England), 13 Jul., 1850; p. 448; Issue 1544.

[729] (Anon.), 'Court of Common Pleas, Saturday, July 6', *The Times* (London, England), 8 Jul., 1850; p. 7; Issue 20535.

Barry's move to discredit Reid was more than a personal attack, but an assertion that in architecture it was the architect who should have authority. Although Duncannon maintained a low opinion of architects, the Office of Woods, now under the Earl of Lincoln, appointed Joseph Gwilt (1784-1863) in 1845 to arbitrate between Reid and Barry.[730] An architect himself, Gwilt supported Barry's claims against Reid. It was an opinion which carried weight. Gwilt had over forty years of architectural experience, as well as of engineering works with the sewers of Kent and Surrey between 1805 and 1846.[731] His 1842 architectural encyclopaedia had become a seminal handbook. In it he included substantial sections of Barry's 1839 stone report for Parliament and praised the credibility such an experimental approach held with 'every scientific person'.[732] Like Barry, Gwilt had been an early supporter of the RIBA, attending the institute's second meeting in December 1834. He not only shared Barry's conception of architecture as a science, but lauded the architect's own skill in practically applying knowledge to the problems of construction. At the Reform Club, where Barry had overseen the installation of a ventilation system in 1839, Gwilt was impressed by the project, which was powered by a five horse-powered steam-engine.[733]

Gwilt was sure that Reid's plans were incompatible with fire-proofing the Palace and that Barry should take complete control over the project.[734] He conceded that Reid was a man of 'skill and science', but felt that he lacked knowledge of design and construction.[735] The problem, as Gwilt saw it, was that Parliament was a building without parallel of scale within Europe and that it required the practical knowledge of an architect to bring it to completion. When the Tory naval authority, Howard Douglas, asked how long architecture and ventilation had been 'distinct professions', Gwilt felt it to have been about

---

730 M. H. Port, 'Problems of Building in the 1840s', in M. H. Port (ed.), *The Houses of Parliament*, (New Haven, 1976), pp. 97-121, 113 and 116.

731 Roger Bowdler, 'Gwilt, Joseph (1784–1863)', *Oxford Dictionary of National Biography*, Oxford University Press, 2004; online edn, Oct 2007 [http://www.oxforddnb.com/view/article/11811, accessed 4 Dec 2013].

732 Joseph Gwilt, *An encyclopaedia of architecture, historical, theoretical, and practical*, (London, 1842), pp. 457-78.

733 John Olley, 'The Reform Club: Charles Barry', in Dan Cruickshank (ed.), *Timeless Architecture: 1*, (London, 1985), pp. 23-46, 38.

734 *Reports from the Select Committee of the House of Lords appointed to inquire into the progress of the building of the Houses of Parliament, and to report thereon to the house: together with the minutes of evidence taken before the said committee*, PP. 1846 (719), p. 15.

735 *Third Report from the Select Committee on Westminster Bridge and new palace; together with the minutes of evidence, appendix, and index*, PP. 1846 (574), p. 37.

fifteen years, but stipulated that in both domains it was the architect who should maintain authority.[736] Reid's plans appeared 'incomprehensible' and demonstrated that ventilation should be considered a branch of architectural knowledge.[737] Reid rejected Gwilt's judgement on the grounds that he did not have a true scientific understanding of ventilation. A select committee was appointed to investigate further, consisting of three individuals of scientific and engineering experience to assess the confrontation.[738] Philip Hardwicke, George Stephenson, and Thomas Graham reported on Reid's system as a work of practical science, but deemed it too complicated.[739] In response, once again, Reid declared the report to be biased and demanded 'a fair and impartial inquiry' which would consider his success in the temporary Commons.[740] At stake here were questions of Reid's professional autonomy.

The Lords subsequently appointed a select committee, at which Barry changed his approach. Rather than question Reid's credentials as a gentleman, or the practicality of his ventilation system, Barry instead laboured to undermine Reid's claims to be scientific. He blamed Reid for the delays in completing the Upper Chamber before establishing himself as an authority on ventilation. He understood 'the theory of the system', which he felt had 'nothing whatever that is new in it'. Reid's was a scheme which appeared similar to those 'adopted by all scientific persons engaged in the practice of warming and ventilating buildings'.[741] Seemingly the only novelty of Reid's work was the scale and importance of the Palace. Barry believed that ventilating Parliament demanded 'great mechanical skill, a thorough knowledge of the arts of construction, sound judgement and decision … in all which attainments and qualities of mind Dr. Reid is … most certainly deficient'.[742] Barry excluded any reference to experiment or chemistry in this assertion. In short, he attacked Reid's reputation as someone who practiced useful science.

---

[736] Ibid., p. 41.

[737] Ibid., p. 43.

[738] *Report from the Select Committee on Westminster Bridge and new Palace*, PP. 1846 (177); *Second report from the Select Committee on Westminster Bridge and new Palace*, PP. 1846 (349).

[739] PP. 1846 (574), pp. 172-3.

[740] Ibid., p. 174.

[741] PP. 1846 (719), p. 9.

[742] Ibid., p. 9.

Barry's attack on Reid found support from Goldsworthy Gurney, himself a practitioner of experiment, who presented evidence undermining Reid's boasts of a practical system of ventilation. Gurney spoke with a 'good deal of practice in the way of experiment' when he declared that Reid's system lacked power.[743] Gurney performed experiments which indicated that heating 1,000 cubic feet of air from 60 to 500 degrees Fahrenheit consumed one pound of charcoal. To draw air through Parliament would demand a temperature of 500 degrees in the central tower. Gurney calculated that if Parliament covered ten acres, then this amounted to 2,393,600 cubic feet of air passing through the system every minute which he believed to require 2,000lbs of charcoal a minute to sustain.[744] Barry reiterated that he himself had the knowledge and skills to introduce a scientific system of ventilation.[745] Interestingly though, this included maintaining the 'great spaces' Reid had claimed above the ceiling and beneath the floor of the debating chambers.[746] Barry preferred Gurney's advice, having consulted Faraday over his credentials and believing the experimentalist to have avoided looking into a chemistry textbook for twenty-five years.[747] Gurney avoided the constant experimenting that made Reid so unreliable.

The press soon caught wind of Reid and Barry's disagreement and the controversy was made public. During the dispute, neither Whig nor Tory ministry gave a firm lead to the work, partly because neither side wanted to take responsibility for something which might end in failure. At the same time neither wanted to abandon the project.[748] To lead it might have been embarrassing, but to abandon it risked condemnation for undermining work which might aid MPs' material well-being. By 1845 this political refusal to remove Reid appeared paradoxical in the press. Prime Minister Peel was lampooned for his refusal to abandon the chemist:

Peel's patronage of Dr. Reid,

Is very natural indeed,

---

[743] Ibid., p. 24.

[744] Ibid., p. 25.

[745] Ibid., p. 38.

[746] Ibid., p. 40.

[747] 'Letter 3473: Charles Barry to Michael Faraday', (6 Jul., 1860), in Frank A. J. L. James (ed.), *The Correspondence of Michael Faraday: Vol. 5: Nov., 1855-Oct., 1860, Letters 3033-3873*, (London, 2008), p. 405.

[748] M. H. Port, 'The failure of experiment', in Crook and Port (eds.), *The History of the King's Works*, pp. 209-49, 228.

For no one need be told

The worthy scientific man

Is acting on the Premier's plan

Of blowing hot and cold.[749]

Reid's work was constructed as analogous to the state of British politics. Such political comparisons were part of wider concerns over the direction architecture was heading and the role that science had to play in this. From 1845 the press orchestrated an intense campaign against Reid. Reid believed, probably correctly, that it was Barry who had initiated this public attack.

In June 1844 *The Times* noted that no one, except Reid, really cared about the air of Parliament, other than the Commons and Lords.[750] In the engineering press, early concerns were raised over Reid and Barry's relationship, but dismissed as a simple question of authority which would be solved.[751] By 1845 this indifference had turned into condemnation. While Reid employed the term 'experiment' as a mark of empiricism, *The Times* deployed the epithet as a derogative. That the Earl of Lincoln sanctioned further experiments, when the building was under pressure to be completed, was construed a monstrosity. The publication believed that a 'more egregious failure than Dr. Reid's "experiments" have hitherto proved' could not be imagined. Correspondents from *The Times*, having sat uncomfortably in the gallery of the temporary Commons, testified to his failings. Reid's experiments were not improvements but 'delusions', and his apparent ignorance of true science demanded scrutiny from 'some men of undoubted science'.[752]

The publication's sudden change from mild praise to utter contempt of Reid's work mirrored Barry's own mounting dislike of the ventilator's schemes. It revealed how the appropriateness of experiment was contingent on the building under investigation; experiment in the permanent was not the same as in the temporary Parliament. Barry and the press believed enough time had been spent producing

---

[749] (Anon.), 'Epigram', *The Times* (London, England), 2 Jul., 1845; p. 4; Issue 18965.

[750] (Anon.), 'We have had on our table…', *The Times* (London, England), 3 Jun., 1844; p. 5; Issue 18626.

[751] (Anon.), 'Mr. Barry – The Lords, and the Parliament Houses', *The Civil Engineer and Architect's Journal*, Vol. VII (London: Jun., 1844), pp. 217-23, 217.

[752] (Anon.), 'We heard last night…', *The Times* (London, England), 21 Mar., 1845; p. 5; Issue 18877.

knowledge and that to be scientific at Parliament involved the referencing of existing knowledge. *The Times* continued this criticism throughout the summer of 1845. After an intensely hot night in the temporary Commons, the publication damned those still 'deluded by his pseudo-scientific pretensions'. With the Commons hotter than 'a chamber at Sierra Leone', Reid's experiments appeared to be endangering the legislature's health.[753] **(Fig. 23)**

In select committees Reid cited experiments as evidence, appearing as truthful observations, but beyond the confines of government his methods were characterized as dangerous. This reputation was exacerbated by accounts filtering through into the press of experiments gone wrong. In 1846, while 'Dr. Reid was trying some experiments with wood, as a substitute for other fuel', he managed to set fire to the door of the Commons. It was reported how this mishap almost erupted into a re-enactment of the 1834 fire before immediate action and a fateful supply of water rescued the chamber.[754] Although costing only a door, such experiments damaged Reid's reputation.

Dangerous experimenting was one thing, but when Reid's scientific pretensions began to influence government business, public outcry escalated into a fearsome storm. As with so many careers at Westminster, Reid was to find Irish Catholicism particularly problematic. In 1845 Peel, in a bid to improve relations with Ireland, sought to increase the British government's grant to the Catholic seminary of St Patrick's in Maynooth. This increase from £8,000 to £26,000 annually incurred a prolonged three day debate during the summer heat.[755] On 5 June Brougham declared that he had had enough. It was intolerable for four-hundred Peers to be packed in a chamber from 10am until 4am every day and be expected to produce efficient legislation. Brougham found support from the Marquess of Normanby who warned his fellow Lords not to blame Reid, but to demand Barry work with increased diligence at Westminster.[756] **(Fig. 24)** Brougham believed Barry's assurances were valueless and accused the architect

[753] (Anon.), 'The Great Ventilator', *The Times* (London, England), 28 Jun., 1845; p. 5; Issue 18962.

[754] (Anon.), 'Dr. Reid setting fire to the House of Commons', *The Morning Post* (London, England), 22 Jul., 1846; p. 2; Issue 22662.

[755] Port, 'The failure of experiment', p. 225.

[756] House of Lords debate, 5 Jun., 1845, *Hansard*, 3 Series, Vol. 81, pp. 120-1.

of 'resisting the authority' of the Lords.[757] Both Lord Campbell and the Duke of Wellington supported these sentiments.[758]

Although Brougham was critical of Barry, the press were quick to attack Reid's experiments as the cause of the poor atmosphere within the Lords. *Punch* took up Brougham's concerns and found Reid entirely to blame. Reid's ventilation was not science because it was not practical. In Reid's 'atmospheric catalogue' there was every kind of air 'but one … the air of practicability'.[759] Likening Brougham's plight to being 'imprisoned in an exhausted receiver', *Punch* lambasted Reid for treating the Lords as animals and the chamber as a giant air-pump.[760] While it was fine to experiment in a temporary House of Commons, to experiment in a permanent House of Lords was considered outrageous. *The Times* echoed these sentiments. Noting analogously that, 'progress with the House of Lords seems to be practically as well as politically difficult', the publication was critical of Reid's infringement on the authority of Barry. Reid's experiments were 'intruding on the province of the architect'. This change in *The Times'* attitude to Reid's work was marked. While once the Conservative leaning journal had praised his experiments, after several years without finding an appropriate system, the paper turned on Reid.

The Times advised its readers to pity Barry when hearing 'that scientific persons have been "assisting" him'.[761] 'Experiments' were the only hindrance to the completion of Parliament, while there was 'not upon the face of the civilized earth a more impracticable set of people than the *savans*'.[762] It was not science as a body of knowledge that was attacked, but science as a method of producing evidence. Referencing knowledge was considered practical, while experiment was portrayed as troublesome. A savant like Reid was to be kept away from the competent profession of architecture and given some unimportant unoccupied building for his experimenting. Reid's orders to Barry were reckoned about as practical as

[757] House of Lords debate, 5 Jun., 1845, *Hansard*, 3 Series, Vol. 81, p. 122.

[758] House of Lords debate, 24 Jul., 1845, *Hansard*, 3 Series, Vol. 82, p. 1033.

[759] (Anon.), 'Dr Reid's Process', *Punch*, Vol. X (London, 1846), p. 218.

[760] (Anon.), 'Brougham and Reid', *Punch*, Vol. X (London, 1846), p. 263.

[761] (Anon.), 'Poor Lord Brougham...', *The Times* (London, England), 20 Mar., 1846; p. 4; Issue 19189.

[762] Ibid..

attempting 'to manufacture a moon out of a given quantity of cheese'.[763] In what the *Illustrated London News* asserted to be the greatest architectural work since the fire of London, the only practical mind at work in Parliament was deemed to be Barry's.[764]

After warning that the 'Legislature is evidently not safe in the hands of this aerial Guy Fawkes', *The Times* expressed a distrust of natural philosophers who professed ventilation knowledge. **(Fig. 25)** It hoped that if Reid was removed, Goldsworthy Gurney would not be chosen to replace him. Gurney was also a product of 'ventilation mania', favouring continuing experiment, and so was not to be trusted. It was reported how 'Gentlemen with such views as these are not the proper persons to take into consultation on practical matters'. Furthermore, 'until the scientific gentlemen can agree upon … a practical atmosphere upon a new plan, the ordinary principle of ventilation … shall be applied'.[765] Existing knowledge was to be trusted, rather than dangerous methods for constructing new evidence. According to *The Times* what the public wanted at Westminster was a trusted architect to deliver practical knowledge. Not the radical suggestions of false natural philosophers who professed to produce new knowledge.

While Brougham's main target was Barry, as delays to the Lords' chamber continued his enthusiasm for further experiment diminished. All Brougham wanted was a completed chamber. Nevertheless Reid still found some support in the Upper House. Lord Campbell, who like Brougham had been impressed with Reid's work at the 1834 BAAS meeting in Edinburgh, defended him as 'a man of eminent science'.[766] Lord Sudeley also praised Reid's work in the Commons as the first project of 'systematic ventilation ever carried out' and warned the Peers not to replace the man of science with one 'whose knowledge of the science of ventilation' was unproven.[767] Both Campbell and Sudeley agreed the experiments were 'detestable' but if given time would yield progressive knowledge. However beyond the discomforts of the Lords, Reid's experiments had publically lost almost all credibility. Reid's experiments could not be allowed

[763] (Anon.), 'The same committee which was appointed…', *The Times* (London, England), 17 Aug., 1846; p. 4; Issue 19317.

[764] (Anon.), 'National Works', *Illustrated London News* (London, England), 19 Feb., 1848; p. 95; Issue 303.

[765] (Anon.), 'Dr Reid has at last found an adherent…', *The Times* (London, England), 27 May, 1846; p. 5; Issue 19247.

[766] House of Lords debate, 24 Apr., 1846, *Hansard*, 3rd Series, Vol. 85, p. 975.

[767] House of Lords debate, 26 Jun., 1846, *Hansard*, 3rd Series, Vol. 87, p. 1034.

to 'interfere with the practical business of every-day life'. Reid's knowledge of the number of respirations it took to consume a given atmosphere was an amusing 'theory', but hardly aided his boasts of adding twenty per cent to the life-expectancy of legislators.[768] Accompanying this press driven sentiment were concerns raised within scientific circles. At a meeting of the Royal Institution, Faraday, who was assisting Barry in planning his own system of ventilation in the Lords, raised doubts over Reid's experiments and the practicality of his system in the Commons.[769]

While Reid's science struggled for credibility, it is apparent that his own scientific conduct made it difficult for him personally to secure trust. The challenge of transferring Reid's work to Parliament was about much more than questions of authority with Barry. At stake were much wider concerns over scientific method. In Chapter Two we saw how Barry built Parliament in the context of debates between John Stuart Mill and Whewell over what constituted good science. A great deal of Whewell's criticism of excessive empirical data collecting was aimed at the culture of experimentalism prevalent in 1830s' Edinburgh. In particular Whewell's writings challenged Brewster and Brougham's commitment to the full time pursuit of experimental inquiries.[770] Whewell denounced their obsession with originality and search for truths at the expense of theorizing. Reid displayed a similar enthusiasm for endless experiment and had impressed Brougham and Brewster in Edinburgh. It seems likely then that for London audiences, Reid's work appeared typical of an Edinburgh scientific framework which Whewell so forcefully condemned. Even Faraday had reservations over the quality of Reid's work. As early as 1831 Faraday received a letter from the chemist Richard Phillips (1778-1851) complaining of Reid's approach to chemistry. Faraday recalled reading this scathing account on a coach to Hastings, finding the portrayal of Reid's experiments so amusing that he left his fellow passengers quite disturbed at his frequent outbursts of hearty laughter. Faraday surmised that Reid produced a few new facts of limited value, but nothing more; no evaluation or

---

[768] (Anon.), 'The Lords seem at length determined…', *The Times* (London, England), 6 Apr., 1846; p. 4; Issue 19203.

[769] (Anon.), 'Dr. Reid's Lecture in Reply to Dr. Faraday's on Ventilation', *The Morning Chronicle* (London, England), 17 May, 1847; Issue 24200.

[770] Richard Yeo, *Defining Science: William Whewell, natural knowledge, and public debate in early Victorian Britain*, (Cambridge, 1993), p. 91.

analysis.[771] Reid lacked what Whewell would have considered to be the essential quality of imaginative thinking, leading on to scientific theorizing.

Reid's constant experimenting and search for empirical observations was suitable in Edinburgh where men like Brougham and Brewster chased proofs and truth, but in the more diverse setting of Westminster the continual alteration of architectural design subject to experimental findings appeared as a terrifying realization of Whewell's fears.[772] What Barry wanted was not Scottish experiments, but a workable theory on which to practically base his work. He continually showed this throughout the project in relation to ventilation, geology, cast-iron construction, and above all when consulting Faraday. When Barry referenced Faraday he was seeking permanent knowledge, stable and true, for a permanent Parliament. One crucial difference between Reid and Faraday was that while Reid produced chemical knowledge within Parliament, which was itself a place of political performance, Faraday's work went on in the laboratory of the Royal Institution with, as we shall see in Chapter Five, clear spatial divisions between places of knowledge production and display. For Faraday, chemical findings made in his laboratory came into public view once their status as experiments was made stable and their meaning interpreted. Reid on the other hand, in both experimenting and displaying in the House of Commons, appeared unable to clearly distinguish established chemical knowledge from on-going unstable experiments. The types of knowledge Reid produced resembled progressive knowledge which, as Whewell explained, if not handled carefully induced radical instability and dangerous forms of political thought.[773] It is significant then that through depictions in *Punch* and *The Times* Reid was characterized as a Guy-Fawkes-like character that might bring about Parliament's destruction. Radical progressive science threatened the existence of the nation's elected assembly.

Over the next few years the unrelenting campaign against Reid's experiments secured increasing weight. *The Athenaeum* joined in this attack, reporting that in Reid's attempts to ventilate Parliament, 'as in

---

[771] 'Letter 515: Michael Faraday to Richard Phillips', (23 Sep., 1831), in Frank A. J. L. James (ed.), *The Correspondence of Michael Faraday: Vol. 1, 1811-Dec., 1831, Letters 1-524*, (London, 1991), p. 579.

[772] G. N. Cantor, *Optics After Newton: theories of light in Britain and Ireland, 1704-1840*, (Manchester, 1983), p. 178.

[773] Laura J. Snyder, *Reforming Philosophy: a Victorian debate on science and society*, (Chicago, 2006), pp. 221 and 224.

the Niger ships, he has totally and signally failed'.[774] Several anonymous letters appeared in *The Times* praising the paper's efforts in raising public awareness of Reid's work. One supported Barry in noting that both architects and 'Scientific men' considered Reid's system a 'Humbug'.[775] Another letter, signed 'B', declared the press assault to have left 'The Reid … shaken with the wind' and expected his removal to be imminent. No one trusted his experimenting, 'as he would call it', and Parliament would soon be added to his list of failed ventilation schemes, which already included the Niger expedition ships, the royal yacht, Windsor Castle, and Buckingham Palace.[776] 'A wave or two more' of *The Times'* 'magic pen' and Reid would 'evaporate like a puff of his own foul vapours'. *The Times* was so confident of its power to influence Reid's future that when, after Gwilt's report, three 'scientific gentlemen' were appointed to investigate Reid's system, the publication was sure he would be removed. This appointment was to be a mere formality to tend to the 'vanity' of the chemist. *The Times* believed that Reid would accept being removed if scientific men ordered it.[777] Such judgment would terminate Reid's 'attempt at philosophy'.[778]

The Times was destroying the reputation of not only an Edinburgh experimenter, but of a potentially dangerous political figure. Despite this hostility to Reid, he did manage to maintain his position during the late 1840s. Reid provided a sustained defence of his system as well as his reputation. He published an aggressive response to *The Times*, in which he argued that such a journal had little understanding of chemistry or the atmosphere. The popular press lacked 'knowledge', but through 'reckless assertions' had undermined Reid's credibility.[779] Reid believed that only *The Athenaeum's* review was in anyway reputable: the journal, 'in a calm review of a scientific work, of course receives some degree of credit'.[780] However he endeavoured to show such criticism was misguided. While architecture was a skill of 'ancient days', ventilation was a modern science. Progressive architecture was not to be entrusted to architects like Barry, who in matters

---

[774] David Boswell Reid, *Ventilation. A reply to misstatements made by "The Times" and by "The Athenaeum" in reference to ships and buildings ventilated by the author*, (London, 1845), p. 21.

[775] 'Antiaeeolus', 'Reid Ventilation', *The Times* (London, England), 25 Apr., 1846; p. 6; Issue 19220.

[776] 'B', 'Reid Ventilation', *The Times* (London, England), 9 Apr., 1846; p. 7; Issue 19206.

[777] (Anon.), 'In the course of a discussion…', *The Times* (London, England), 27 Apr., 1846; p. 4; Issue 19221.

[778] (Anon.), 'Dr. Reid has at length…', *The Times* (London, England), 13 Jun., 1846; p. 6; Issue 19262.

[779] Reid, *Ventilation. A reply to misstatements*, pp. 5-6.

[780] Ibid., p. 21.

chemical displayed 'a deficiency of knowledge', but to men of science like Reid.[781] Architects were to be subservient to those with a chemical understanding of ventilation.[782] Reid's knowledge of the atmosphere and respiration, as well as his observations on the diffusion of gases and links to disease, were all recent discoveries. Reid explained that he really had advanced medical knowledge at Westminster, but that the complaints from members were due to incalculable personal demands, often depending on how much they had eaten or drunk before entering the House. The problem was not the system, but that individual members demanded varying atmospheres at different times. One member might be hot while another was cold.[783] This was a problem without solution; it defied scientific measurement. Reid described how the 'thermometer, so constantly appealed to as a standard of comparison, is of little value as a test of the effect of the atmosphere in communicating the sensation of heat, or that of cold'.[784] Predictably, blaming his inability to secure a comfortable atmosphere on the dietary habits of MPs won Reid few friends within Parliament.

When *The Times* labelled his experiments an 'egregious failure', Reid responded that such trials had provided him with knowledge of how to ensure a healthy atmosphere.[785] Although members and reporters might feel discomfort, Reid adamantly defended the integrity of his method. Reid pointed out that few would trust him or his science if *The Times* kept on printing its critical commentaries. In essence, Reid's argument was that his experiments and system were successful, and that the failings were merely problems of personal preference. Reid subsequently published a weighty catalogue of advocates of his work, which included testimonies from Hawes, Lord Sudelely, Lord Campbell, and architects Thomas Brown of Edinburgh and T. Dickson of Manchester.[786] Hawes described Reid's experiments as a 'successful' triumph, while Harvey Lonsdale Elmes, the architect of St George's Hall in Liverpool which Reid ventilated,

[781] Reid, *Illustrations*, p. xii.

[782] Argued in ibid., pp. 70-80.

[783] Reid, *Ventilation. A reply to misstatements*, p. 8.

[784] Ibid., p. 10.

[785] Ibid., p. 11.

[786] CRC PS86.8, David Boswell Reid, 'Extracts from official documents, reports, and papers, referring to the progress of Dr. Reid's plans for ventilation', pp. 1, 4, 5, and 7.

described Reid's investigations at his 'Chemical Laboratory' in Parliament as progressive.[787] David Stephenson, the Scottish civil engineer, praised the effectiveness of Reid's techniques when employed in lighthouses. What such witness accounts asserted was that Reid could be trusted with the health of the nation's legislature.

Despite this, *The Times* continued to press its claims that Reid's work was inappropriate for Parliament. If indeed Reid did perform scientific experiments, which *The Times* doubted, the new Parliament was just not suitable for such trials. The temporary Houses might be claimed by 'scientific experiment', but to employ the new chambers 'as instruments for advancing the great cause of ventilating philosophy' was egregious. The 'magnificent domicile of a Legislature … of the most powerful empire in the world' was not an appropriate place of experiment. It was a place for architectural 'genius' combining artistic inspiration and the successful application of knowledge to building problems, and this Barry provided.[788] The condemnation of Reid's work was enough to lose him control over the ventilation of the Upper Chamber. A separating wall beneath the two chambers was constructed and from 1846 until 1852 two systems of ventilation at Parliament were trialled. In the Lords, Barry drew air in through the Victoria Tower before passing it through water for purification and then forcing it into the chamber via pipes and powered by fans. Air descended into the chamber, but was pre-cooled or warmed in the basement air chamber.[789] Reid's system for the Commons took in air through the Clock Tower before heating or cooling it with water, and then allowing it to enter via holes in the floor of the Commons. This was powered by a current sustained by the central tower and a steam-driven fan.[790]

According to *The Times*, Barry's system of descending air in the Lords brought "'airs from heaven," not "blasts from hell"'.[791] **(Fig. 26)** Barry was constructed as a trustworthy producer of well-ventilated

[787] Ibid., pp. 4 and 7.

[788] (Anon.), 'The New Houses of Parliament', *The Times* (London, England), 5 Apr., 1847; p. 3; Issue 19515.

[789] Dale H. Porter, *The Life and Times of Sir Goldsworthy Gurney: gentleman scientist and inventor, 1793-1875*, (Bethlehem: 1998), p. 178.

[790] Ibid., p. 179.

[791] (Anon.), 'The New Houses of Parliament', *The Times* (London, England), 5 Apr., 1847; p. 3; Issue 19515; compare this with the architecture of the English electric lighthouse at the 1867 Exposition Universelle which was condemned

architecture, as he employed existing knowledge in his designs, referencing respectable authorities, like Faraday. Simultaneously Reid's credibility was deconstructed because his science was not a consistent body of knowledge, but a method, considered untrustworthy and dangerous. While Barry's science appeared solid and consistent, Reid's was apparently ever changing and subject to varying results produced through experiment. Barry's knowledge promised a coherent plan and ordered approach to complete Parliament. Reid's held no promise of completion and risked perpetual disorder at Westminster. For five years architect and chemist ran competing systems as a trial under the scrutiny of a committee featuring authorities in matters of practical science, including Faraday, Wheatstone, and the naval architect, John Scott Russell.[792] When the Commons moved into their new chamber they complained so much of Reid's system that John Manners, then Commissioner of the Board of Works, was compelled to sack the chemist and replace him with Barry's engineer, Meeson.[793] An 1852 select committee reported on Barry's relative success compared to Reid's endeavours. Despite this, concerns remained about Barry's lighting which produced so much heat as to undermine his ventilation scheme.[794] Neither architect nor chemist produced a system which won unanimity. At the suggestion of Barry's work in the Lords being a success, Reid stipulated that Barry had merely imitated his own practices. Reid recalled how in 1838, Barry had visited his experimental lecture room in Edinburgh and made detailed observations of his ventilation practices.[795] Nevertheless such allegations of plagiarism provided scant consolation for the Edinburgh chemist.

Conclusion: a tale of two cities

---

as unacceptably temporal, in Patricia Mainardi, *Art and politics of the Second Empire: the universal expositions of 1855 and 1867*, (New Haven, 1987), pp. 146-7; thanks to Jane Garnett for this.

[792] *First report from the select committee on new House of Commons*, PP. 1850 (650, 650-II), p. iii.

[793] Porter, *The Life and Times of Sir Goldsworthy Gurney*, p. 179; *Ventilation and lighting of the House committee. Report of the standing committee on the ventilating and lighting the House of Commons*, PP. 1852-53 (570), p. 1.

[794] *Second Report from the Select Committee on Ventilation and Lighting of the House; together with the proceedings of the committee minutes, of evidence, appendix and index*, PP. 1852 (402), p. vi.

[795] Reid, *Narrative*, p. 25.

The challenges of moving science from Edinburgh to Westminster and then from the temporary to permanent Parliament buildings were technical and social, but they were also methodological. Reid's epistemological framework was as controversial as the integrity of his ventilation apparatus. Experimenting in Westminster was very different to experimenting in Edinburgh. While in Scotland Reid found an audience sympathetic to his continual data collecting and commitment to finding new truths, at Parliament his constant experimenting aroused fear and condemnation. To conduct ceaseless experiments in an Edinburgh classroom in the hunt for truth was one thing, but to do the same within the walls of the Palace was quite another. At stake were very different models of what constituted good knowledge. While Barry worked in accord with what he considered to be permanent, stable knowledge, Reid appeared a conveyor of temporal evidence, which might change at any given moment subject to new experimental findings. Barry's permanent Parliament required permanent knowledge. Of course this is not to say experiment was unacceptable altogether. Such practices contributed to Barry's report on stone and also to the evidence which Faraday provided. However in each case experiment provided material which supported a fixed body of knowledge which could be referenced once established. Barry helped first to produce the report on stone, and it was then consulted once agreed on. Faraday provided evidence that had been tested at the Royal Institution and then interpreted into stable ideas. Reid provided ideas, but these regularly changed and rarely attracted any kind of wider consensus. As will be shown in the next chapter experimental work at Westminster could succeed, but only if managed in a way that preserved enough confidence in Parliament.

It should come as little surprise that the main critic of Reid was the Conservative *The Times*. Reid was committed to an Edinburgh programme of experiment which, particularly for Whewell, carried dangerous political implications. Knowledge made through continual experiment for practical applications was typical of an Edinburgh epistemological model which Reid epitomized. As already shown, both these attributes were hallmarks of the radical science of John Stuart Mill. If we place Reid within this experimental Edinburgh programme then it becomes apparent that his work was not only scientifically controversial but politically radical. It is not too much to suggest that when Barry undermined Reid's reputation, or Reid appeared in *Punch* or *The Times* as a nineteenth-century Guy Fawkes threatening to destroy Parliament through his experiments, he was being characterized as a politically dangerous figure. While radical

politicians wanted reform and an end to the established political order Reid, through his ventilation schemes, was literally threatening to do this. In his hands, science became a means to radical ends. Utilitarians might talk of reforming Parliament and ending aristocratic privilege but Reid actually risked the physical integrity of the Palace of Westminster and the health of MPs. At Parliament science appeared a radical force, not just for its content, but politically. The Edinburgh enthusiasm for experiment seemed capable of doing what no amount of popular unrest could.