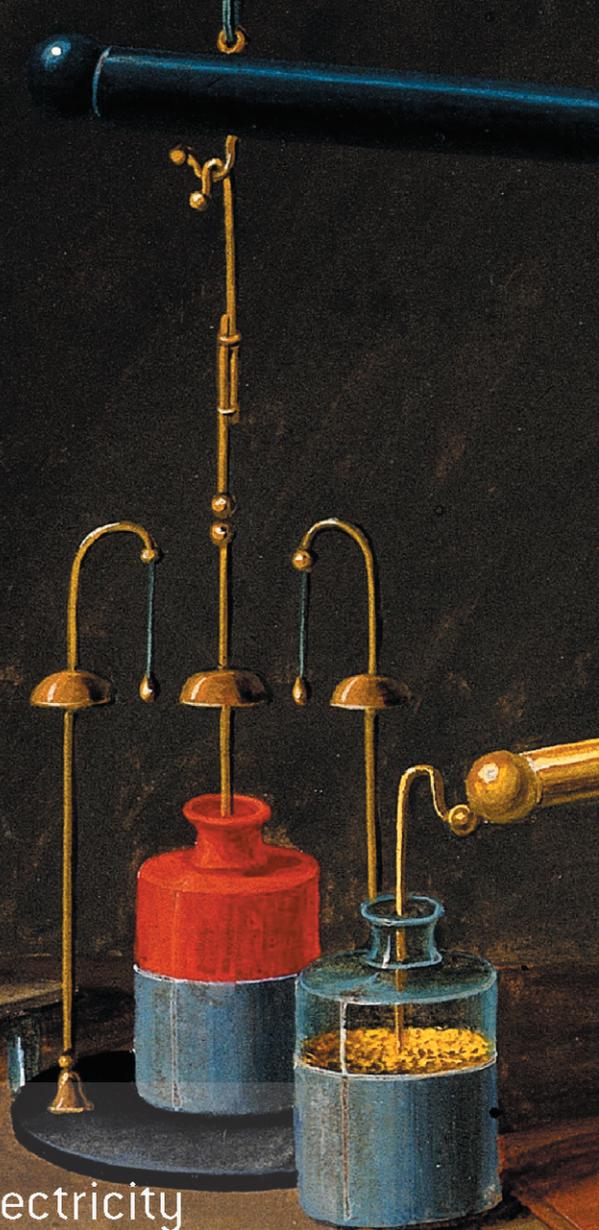


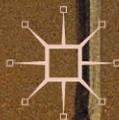


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Literature, Electricity
and Politics 1740–1840:
'Electrick Communication
Every Where'

MARY FAIRCLOUGH



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Mary Fairclough

Literature, Electricity and Politics 1740–1840

‘Electrick Communication Every Where’

palgrave
macmillan

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Palgrave Studies in Literature, Science and Medicine
ISBN 978-1-137-59314-6 ISBN 978-1-137-59315-3 (eBook)
DOI 10.1057/978-1-137-59315-3

Library of Congress Control Number: 2016962210

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The registered company is Macmillan Publishers Ltd.
The registered company address is: The Campus, 4 Crinan Street, London, N1 9XW,
United Kingdom

ACKNOWLEDGEMENTS

During the writing of this book I was the grateful recipient of grants from the British Academy, the ARC Centre of Excellence for the History of Emotions in Australia, the UK Arts and Humanities Research Council and the Henry E. Huntington Library and Jack Miller Center, which enabled me to travel to some of the most beautiful research spots in the world, and Birmingham. Thanks to the librarians and archivists at the J. B. Morrell and King's Manor Libraries in York, the Brotherton Library in Leeds, the British Library, the Chemical Heritage Foundation and Library Company of Philadelphia, and the Huntington Library, for their guidance and help. Thanks to the editors of *POETICA* for allowing me to reproduce in parts of [Chapter 2](#) in an expanded form. Thanks to Ben Doyle, Tom René and Eva Hodgkin at Palgrave Macmillan for guiding me through the production process so humanely and efficiently, and to the anonymous reader at Palgrave for his or her astute and constructive comments on the manuscript.

This is a book made in York. My greatest thanks and appreciation go to John Barrell and Harriet Guest for their inspirational example and their support over many years. Friends and colleagues at the Centre for Eighteenth Century Studies at the University of York make it the best place to do what I do. Special thanks to Jon Mee for innumerable generousities and good counsel, to Emma Major, for kindly reading drafts of this work, and to Clare Bond, Kevin Gilmartin, Natasha Glaisyer, Mark Jenner, Catriona Kennedy, Alison O'Byrne, Jim Watt and Chloe Wigston Smith. Thanks too to students at CECS past and present, especially Madelaine Schurch, Montana Davies-Shuck, Ben Jackson, Harriet Neal and Alice

Rhodes, whose electrical insights and enthusiasm were especially valuable in the closing stages, and to Sophie Coulombeau, Ruth Scobie and Joanna Wharton. Warm thanks to colleagues and comrades in the Department of English and Related Literature at York, especially David Attwell, Claire Chambers, Kenneth Clarke, Michelle Jepson, Alice Hall, Hugh Haughton, Cathy Moore, Emilie Morin, Naomi Prescott, Bryan Radley, Deborah Russell, Richard Rowland, Helen Smith and Claire Westall.

Beyond York, Catherine Bates, Jeremy Davies, Richard De Ritter, David Higgins, Alys Mostyn and Cassie Ulph have made Leeds feel very much like home. Paul Keen, Julie Murray, Sharon Ruston and Jan Golinski have offered kind interest and support at opportune moments. I feel I have a research home from home in Adelaide; thanks to Jacquie Bennett, Katie Barclay, Heather Kerr, David Lemmings, Mary Luckhurst and Eric Parisot. The friendship and scholarship of Liz Edwards, Georgina Green and Alex Watson has been and continues to be enormously important to me. Thanks for many adventures in Romanticism Emily Stanback and Polly Atkin; I hope there are more to come. Richard Palliser, Rose Pimentel, Richard Mounce and baby Michael, thanks for keeping a seat for me in York. And Jane Grogan, Kate Highman and especially Michelle Kelly you remind me again and again that there is more to life than work. Thank you!

To Justin Ions, fellow-labourer, index-checker, joy-bringer, love and thanks. And thanks and deep appreciation to my lovely family, Caroline, Oliver, Jane, Nick, Hugh, Basia and Maya.

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Introduction: Electricity, Spectacle and Figuration

Lectures on Electricity, Lecture II.

VI. Spirits kindled by fire darting from a lady's eyes (without a metaphor).

Ebenezer Kinnersley, advertisement, *Pennsylvania Gazette*
(18 April 1751).

Their language is vitally metaphorical; that is, it marks the before unapprehended relations of things and perpetuates their apprehension . . .

Percy Bysshe Shelley, *A Defense of Poetry* (1821).

During the eighteenth century, electrical experimentation was both science and spectacle, the subject of legitimate investigation and illegitimate display. Electricity was claimed as evidence of enlightened man's control over the natural world, and of nature's limitless and wonderful capacity to elude quantification and taxonomy. Electricity also transcended the divide between elite philosophical institutions and broader social and cultural practices. An article in the *Gentleman's Magazine* of April 1745 declared that in the previous two years, experimenters had 'discovered phenomena, so surprising as to awaken the indolent curiosity of the public, the ladies and people of quality, who never regard natural philosophy but when it works miracles. Electricity became the subject all in vogue.'¹ Electricity was indeed natural philosophy 'in vogue', as spectacular electrical displays proved immensely fashionable in Germany, France and England. Eighty years later, Humphry Davy upheld the *Gentleman's* sense of a surge in interest in electricity during the 1740s, and noted that it had been produced by developments in electrical

equipment. The invention of the Leyden jar in 1743 had created a new epoch in electrical experimentation, because it allowed experimenters to store an electric charge and discharge it all at once, with spectacular effects. For Davy, the Leyden jar produced new social as well as experimental phenomena:

No single philosophical discovery, ever excited so much popular and scientific attention . . . The apparatus soon became an object of public exhibition; and in the same year in which it was discovered, a number of itinerant experimenters procured a livelihood in different parts of Europe, by travelling from place to place, and showing the experiment.²

As the *Gentleman's* article and Davy's lecture both imply, though electrical practitioners discovered 'phenomena' through which they could demonstrate the operation of electricity, explanations of its causes were far more difficult to come by, especially given the limited expertise of many 'itinerant experimenters'. In 1787, even after decades of attempts to explain electrical phenomena, the instrument maker George Adams was forced to agree, declaring that 'as electricity is in its infancy, when considered as a science, it's [sic] definitions and axioms cannot be stated with geometric accuracy'.³ Electrical science thus achieves a peculiar status during the eighteenth century. It is a highly visible and popular form of entertainment as well as experiment, but one that resists the attempts of natural philosophers of all kinds to assign it a recognisable cause and stable meaning.⁴ The most commonly employed explanation of electrical phenomena is that electricity is one of several 'imponderable fluids' including heat, light, fire and magnetism, but this model offers few answers about its precise nature.⁵

The apparently inexplicable quality of electricity makes electrical discourse an important, and troublesome, object of enquiry, not just for historians of science, but for analysts of eighteenth-century culture and thought more broadly. This book will address the peculiar status of electrical discourse in the long eighteenth century, arguing that the language of electricity is never confined to natural philosophy during this period. The occurrence of such language in literary and political writings is not a matter of mere borrowing, but rather a symptom of electricity's resistance to definition. In the chapters that follow, I trace the use of electrical language in natural and moral philosophical treatises, in newspaper articles and advertisements, in poetry and novels, and in radical and conservative political pamphlets and journals. Such uses of electrical language are evidence that a huge range of eighteenth-century commentators were alert to the

multiple valence of electrical language and deployed it for their own rhetorical ends. But writers' use of such language to describe certain species of phenomena is not an arbitrary choice. Their appropriations of electrical language indicate that ideas about electricity informed ideas about other forms of natural, cultural and political life, in particular the constitution of matter, conceptions of universal or individual vital forces, the nature of sexual attraction, and the source and function of revolutionary communication. But despite the claims of some commentators, electrical language very rarely signals confidence in enlightenment or progress at this period. Electrical imagery and ideas are not used to account for or explain such phenomena but rather to signal mystery and opacity, and their associated threats, frustrations or opportunities. Dealing with the wealth of discussions of electricity produced during the period 1740–1840 has proved a methodological challenge. I have mostly restricted myself to the discussion of Anglophone texts, either British or American works, or European texts available in translation during this period. This approach cannot do justice to all of the cosmopolitan alliances between electricians across Europe and America, but I gesture to the use that English language texts made of such international collaboration and competition.

In 1796, Edmund Burke accounts for the cause and effects of the spread of revolutionary ideology in France using the metaphor of electric communication in his counter-revolutionary polemic *Letters on a Regicidal Peace*. Burke identifies a 'silent revolution in the moral world [which] preceded the political, and prepared it', namely the increasingly powerful financial and political interests of the middle classes. This 'revolution' is catalysed through the influence of 'above all, the press . . . [which] made a kind of electric communication every where. The press, in reality, has made every Government, in its spirit, almost democratick.'⁶ Burke's phrase 'electric communication every where' seems to be an attempt to account for the speed with which information is transmitted through the newspaper press. But read in the context of eighteenth-century electrical cultures, the implications of his phrase are even more interesting, and more fraught. Burke's 'electric communication every where' gestures not merely to print on the page, or to the material distribution networks of the newspaper trade, but to the intangible processes through which revolutionary thoughts, actions and feelings are spread from person to person, region to region and nation to nation. Burke seems to signal an anxiety that such electric communication will operate as a catalyst, activating a latent political activism in the individuals that it touches. Electricity

in Burke's text becomes an almost mystical, universal force, one which is apparently universal and intangible, but which has material cultural and political effects.⁷

The chapters in this book will investigate the discursive characteristics of electricity which, by the end of the century, make statements like Burke's possible. Each chapter takes as its starting point a development in electrical practice or theory, and considers the ways in which the resulting conceptions of electricity are taken up in other writings. The diverse bodies of work under discussion are united, in each case, by their common need to respond to or probe the implications of these developments, and by a sense of their broader cultural significance. In [Chapter 2](#), I investigate the experimental culture of the 1740s and 1750s which claimed electricity as a species of aether in the manner of Sir Isaac Newton. Far from producing a stable empirical account of electricity, such claims emphasised the degree to which aethereal models overlapped with and supported accounts of electricity as an immaterial, divine spirit or 'soul of the world'. Such debates over the spiritual nature of electricity have important effects even for later materialist experimenters like Benjamin Franklin and Joseph Priestley, as it remains difficult to declare with certainty whether electricity is a material or immaterial phenomenon. My third chapter analyses medical applications of electricity and the significance of the human body in electrical experiments, focusing on speculative and sensational practices from the 1740s to the 1780s that suggested a connection between electricity and eroticism. The key figure in this discussion is James Graham, who exploits the obscurity of electrical phenomena to claim electricity as a universal healing tool and even the principle of sexual attraction. Graham's claims have been dismissed as charlatanism, but his practice bears important similarities with the 'respectable' electrical research of his contemporaries, and it influences the representations of physical, emotional and political feeling in the work of the Della Cruscan poets.

In [Chapter 4](#), I return to Burke's denunciation of 'electrick communication every where' to examine how Luigi Galvani's investigation of 'animal electricity' and associated claims for electricity's vitalising effects on the body produce a language through which both reformists and conservatives account for political communication and even the vital principle of revolution itself in the 1790s. The physiological basis of this 'electric' revolutionary communication means that it proves difficult to claim it as a force of enlightenment or reason. This disrupts the celebratory claims of even commentators like Erasmus Darwin and John Thelwall, whose knowledge

of physiology enables them to engage in detail with the electrical ‘vital spirit’. And in [Chapter 5](#) I examine how Alessandro Volta’s invention of the ‘galvanic pile’ in 1800, which for the first time enables a constant supply of the electric fluid, produces new conceptualisations of electricity as a chemical and physiological agent. In the work of electrochemists like Humphry Davy the discourses of chemistry and physiology can be seen to mutually inform one another, producing new conceptions of the nature of matter, and of electrical vitality, which are taken up by a variety of writers including Mary Shelley and Richard Carlile. In all these writings, however, the operation of electricity itself remains opaque despite the speculations of experimenters, theorists and philosophers. It is not until the 1830s and the work of Michael Faraday that it becomes possible to quantify and taxonomise electrical phenomena in a systematic fashion. This development, however, brings with it a loss; the wild and varied figurative life of electricity in the period 1740–1840 seems to die away, and with it the sense that electrical language can represent the mysterious, unprecedented or opaque aspects of cultural and political life.

The varied writings under discussion in these chapters testify to the ubiquity of electrical discourse during this period, but they have important characteristics in common. The difficulty of defining the causes of electrical communication leads commentators in diverse fields to adopt startlingly similar approaches in their uses of electrical language. They seem to be united by a realisation of the importance of employing speculative, even imaginative methods to account for electricity’s effects. Such speculative methods are not without controversy however. In 1795 the *Monthly Review* publishes a review by John Leslie of G. C. Morgan’s *Lectures on Electricity* (1794).⁸ Leslie emphasises the dangers that ensue when electricians ‘plunge into obscurity by employing the agency of subtle matter, which eludes the grasp of the senses, and derives all its properties from the creative power of fancy’.⁹ Electrical spectacles are so seductive, Leslie continues, that they have compromised recent philosophical advances:

Scarcely was the empire of reason restored, and the new principles of sound philosophy diffused over Europe, when a new and brilliant scene of discovery was opened up to view. Men were delighted, astonished! They trod in a fairy land; and, after the first transports of admiration were subsided, the explication of the phaenomena seemed to mock the sober efforts of the understanding. Hence that charming science has generally been neglected,

as trivial or unprofitable, by the more profound philosophers. It has become the favourite department of superficial inquirers, who amuse their leisure or exercise their ingenuity by varying the appearances, or by inventing plausible hypotheses.¹⁰

In the *Lectures* Morgan had in fact criticised the ‘imperfect and obscure’ nature of the language of electrical experiment, and declared: ‘It is to be regretted, that in rearing our minds towards perfection, we should ever regard any motives but such as are purely rational.’¹¹ But Leslie concludes that Morgan could not avoid such speculation himself:

He seems to possess more vigour than correctness of conception. Had his sagacity the absolute government of his fancy . . . he might perhaps have effected a memorable revolution in electrical science . . . [but] he seems contented if, by the help of metaphorical language, he can picture to the imagination some distant resemblance to the phenomenon submitted to inquiry.¹²

This review demonstrates the profound uncertainties about the operation of electricity which persist even at the end of the eighteenth century. But the source of its anxiety seems to lie in Leslie’s repeated reference to ‘fancy’ and to figurative language. The science of electricity seems anathema to the practice of ‘profound philosophers’ because it exceeds the bounds of ‘rational’ language and demands recourse to imaginative thought and to metaphorical expression. Many experimenters find, however, that in the absence of empirical evidence, ‘fancy’ is the only means of accounting for electrical phenomena.

The significance of electricity as a public science at this period has been the subject of a range of cultural histories and histories of science. Simon Schaffer, Patricia Fara, Paola Bertucci, James Delbourgo and Jessica Riskin have produced fine accounts of the contested cultural, epistemological and commercial status of electrical science during the eighteenth century.¹³ This book will build on such work, but it will also make the case that the radical figurativeness of electrical language, and the imaginative play of such language across a range of discourses has not received enough attention from practitioners of cultural history or of literary studies. I focus in this book on the textual life of electricity in the eighteenth century. I deliberately use the term textual rather than ‘literary life’, though mindful of this book’s place in a series of studies in literature, science and

medicine. Though I discuss poetry, novels and plays in the chapters that follow, these ‘literary’ texts do not comprise the majority of the writings under discussion here. My aim is not to suggest that electrical language was unimportant in literary writings, but rather to stress what such writings have in common with contemporary philosophical speculations, political polemic and commercial puffery. This approach arises in part out of a concern for historical sympathy and accuracy. As Paul Keen and others have shown, it is crucial to pay precise attention to the meanings of ‘literature’ in the mid and late eighteenth century, and when we do so, we discover that for writers of this period it incorporates a hugely varied and diverse field of writings.¹⁴ But mine is also an approach that the texts under discussion seemed to demand. Electric images proliferate across a strikingly diverse range of writings, and demonstrate the fundamental elements that these discourses have in common, and the importance of reading them alongside one another. Despite the range of writings under discussion, however, I characterise my methods as literary critical, even when reading texts that we might not consider literary. I am interested in the textual features of such writings, the author’s choices in relation to form, voice and imagery, as well as subject. This focus emphasises the complex and fascinating rhetorical work of texts by writers like James Graham or Richard Carlile, who might not be considered literary authors, and the close connections between their texts and contemporary ‘literary’ discourse. The key textual focus of the chapters that follow is writers’ use of figurative language, both to account for the mysterious operations of electricity, and to suggest how electricity stands in for other unaccountable phenomena. I do not attempt a full cultural history of the effects of such diverse textual play, but in each chapter I indicate the importance of such discussions in particular cultural and political contexts.

In the second part of this introduction I analyse the connections between electricity and other ‘imponderable fluids’, and examine the ways in which electricity demonstrates the importance of figurative expression for eighteenth-century philosophical and scientific enquiry. I look at the relationship between metaphor and analogy, and show how electrical discourses complicate any distinction between the two, and thus suggest the importance of poetic figures even in philosophical works. I begin, though, with one English experimenter’s attempts to account for the mysterious operations of electricity in the 1740s and 1750s. This is Benjamin Martin, whose work illustrates and attempts to grapple with electricity’s resistance to quantification, its mysterious

causes and its status as a highly profitable but only quasi-respectable science. Martin's writings, and his own liminal professional status, emphasise the unconstrained character of the 'mysterious fluid' that he undertakes to examine.

1 BENJAMIN MARTIN

Benjamin Martin was an itinerant lecturer, instrument maker and 'country showman', who was denied membership of the Royal Society, and who died bankrupt in 1782, probably through suicide.¹⁵ Though Martin made no acknowledged innovations in theories of electricity, his writings occupy an important place among analyses of the 'mysterious fluid' in the 1740s and 1750s. He attempts a systematic explanation of the operation of electricity, though he admits that this may be a futile task, and his experiments demonstrate characteristics of electricity that remain the subject of investigation throughout the century. Martin emphasises that electrical experimentation is a somatic practice; the human body is a vital component of the apparatus of electrical experiments, and the operation of electricity can often only be measured by these human guinea pigs' testimony of its effects on their bodies. Martin anticipates Joseph Priestley's claim of the Leyden jar that '[e]very body was eager to see and, notwithstanding the terrible account that was reported of it, to *feel* the experiment'.¹⁶ He also demonstrates that electricity operates as a means of communication. Electrical bodies affect other bodies: they transmit shocks, sparks and sensations, or ignite flammable objects such as spirits or gunpowder. Such somatic, communicative effects are appropriated by commentators of all kinds later in the century.

Martin's work demonstrates how and why electrical experimentation raises such important questions about communicative practices more broadly. His itinerant labour and spectacular displays emphasise how electricity enables communication, for instance, between demonstrator and audience, but also between different communities. Martin's professional life demonstrates that these forms of spectacle were by no means 'respectable' philosophical practice, but nonetheless they had powerful, democratising cultural effects, entertaining and enlightening those who, in the words of the *Gentleman's* 'never regard natural philosophy but when it works miracles'. However, we should not dismiss Martin as solely a demonstrator. Though he celebrates electricity's spectacular effects, he also grapples with its resistance to analysis, and the difficulty of assigning

it any practical use. Here Martin is not alone; eighteenth-century experimenters frequently emphasise the problem of electricity's lack of utility.

Martin had written and published popular scientific texts in the 1730s, but saw the spectacular potential of the Leyden jar, and began electrical demonstrations in the 1740s in Bath.¹⁷ In 1746 he published his *Essay on Electricity*, an attempt to explain the curious phenomena of the 'electric virtue', which also publicised his lectures. In his opening statement, Martin discusses efforts to explain the operations of electricity:

As the power and various phaenomena of electricity, which of late have been invented and exhibited in experiments, have greatly amused mankind, and justly raised their wonder and surprize, it is but natural to expect they should appear very anxious about the causes therefore, or manner of accounting for it.¹⁸

But he warns that the popularity of electrical demonstrations might obstruct the kind of systematic experimentation that could identify electricity's 'causes': 'Men . . . have appeared to understand little or nothing of true philosophy, or else . . . have been so affected with novelty and singularity, that the principles they advance are more doubtful and mysterious than the causes and properties of the electric virtue they account for by them.'¹⁹ Despite this critique, Martin frankly states his own ignorance. John Millburn notes of the *Essay* 'As to exactly *what* electricity was, however, he had to admit that he did not know.'²⁰ But he attempts to overcome the uncertainty surrounding the causes of electric phenomena, recruiting Sir Isaac Newton to his cause, and declaring that 'the nature, cause, properties and effects of electric virtue are explicable only on the principles of the *Newtonian Doctrine of Light and Fire*'.²¹ In Martin's account, however, even Newton cannot offer a comprehensive account of electricity's 'causes', and this is also true for other electricians. In [Chapter 2](#) I discuss how Newton's work became the source of claims about electricity in a range of writings from philosophical treatises to public lectures, all of which indicate that Newton's work produces more questions than answers.²²

Martin's Newtonian text is the *Opticks*, and he focuses on the eighth 'Query' in which Newton asks 'Do not all fix'd Bodies, when heated beyond a certain degree, emit Light and shine; and is not this Emission perform'd by the vibrating motions of their parts?'²³ Martin suggests that the 'vibrating motions' of electrical objects are the cause of the heat and

light that are observed in electrical phenomena. But in pinning his explanation so strongly to Newton's query, Martin emphasises the uncertain basis of Newton's work. He notes:

On these principles Sir Isaac Newton accounts very clearly for many of the wonderful phaenomena of nature, especially of the phosphoreal and electrical kinds. For instance; the shining of sea-water in a raging storm; of quicksilver agitated in vacuo; of wood, flesh, and fish, by putrefaction; the *Ignes Fatui*; of stacks of corn, hay, &c. by fermentation, growing wet and firing; the glowing of some worms, insects, and eyes of animals, by vital motions; of *phosphorus*, by attrition, or the action of the acid particles of air; of iron hammer'd very nimbly, till it becomes red hot; of the melted part of steel struck off by a flint; of axle-trees fire by the rapid rotation of the wheels; and of the mixture of some sorts of fluids, producing great heat, accession, and explosion.²⁴

All the examples that Martin quotes are offered by Newton as evidence of the aether. But none of these phenomena are actually electrical; most are the products of chemical processes or of friction. Some of Martin's phenomena, particularly 'the shining of sea-water' and the glowing of insects and of animals' eyes continue to be claimed as electrical throughout the eighteenth century.²⁵ This confusion over which phenomena are electrical is evidence of the obscurity of electricity's operations, and Martin seems to acknowledge as much here.

Though Martin asserts that Newton's work will 'be nearly sufficient to solve all the phaenomena of electricity', he does not attempt to develop Newton's hypotheses, falling back instead on sensory evidence: 'there can be no doubt of the existence of such a subtle matter in the substance of bodies, or of its emission or *Effluviium*, because it can be so easily demonstrated to the senses by experiments'.²⁶ Martin retreats from such speculation to the safety of demonstration. This focus has an economic imperative; in whatever ways the *Essay* might strengthen Martin's reputation as a philosopher, it is his electrical lectures that will keep food on his table.²⁷ The entire second half of the *Essay* comprises descriptions of Martin's 'demonstrative experiments', and as he closes the analytical part, he asserts: 'What I have said, I submit to the judgement of those whose province it is to apply the discoveries of natural philosophy, to the utility and benefit of mankind. My business is chiefly to make the experiments, which I shall now proceed to describe in all their proper circumstances.'²⁸ For Martin neither intellectual nor financial satisfaction is to be found by delving too minutely into obscure causes.

Martin does acknowledge that his empirical focus leaves open the question of electricity's utility. He declares:

I am reduced to the arduous task of answering this very common and important question; *'What is the use of this most wonderful and surprising property of bodies?'* Not but that my answer is very short; and if it were to be but once or twice repeated, would be very easy, viz. *That at present I know so little of its use, as not to be able to form any rational conjecture about it.*²⁹

Rather than risk a 'conjecture' about the use of electricity, Martin makes the experiments stand as evidence of his expertise. His status as a mere commercial experimenter drew criticism from better-connected 'philosophers' like Sir John Freke, Fellow of the Royal Society, who declares of Martin's work, 'I would endeavour to ascertain the laws or principles by which they are performed; which when done, a thousand tricks like legerdemain may be performed by it, by him whose time is little worth.' But for Martin in contrast to Freke, who owns 'I have not employed myself in making experiments in electricity', experiments are vital to the investigation of electrical phenomena.³⁰ They provide evidence from which tentative theory might be drawn, while also engaging the public and earning his livelihood.

Martin's experiments are indebted to a canon of spectacular electrical displays that differed little from context to context in the mid eighteenth century. His account emphasises many of the key features of those experiments, making the human body a crucial component, and demonstrating different forms of communication between the self and the world.³¹ Martin also has a keen eye for the spectacular, and celebrates the commercial basis of his practice. He makes use of a static electrical machine very similar to this one illustrated in Jean-Antoine Nollet's 'Observations sur quelques nouveaux phénomènes d'Électricité', published in 1746 (Fig. 1.1). The operator turns the handle and friction is created as the glass globe rubs against a cushion or leather, producing static electricity. The design of the electric machine used by Martin had changed very little since Francis Hauksbee had patented his model in 1709. And despite regular improvement of the electrical machine by instrument makers, electrical hardware did not fundamentally change until Alessandro Volta's invention of the electric battery or pile in 1800 made it possible to produce a continuous electric current.

Martin makes highly effective use of this basic equipment, describing a series of experiments that not only demonstrate the operation of the

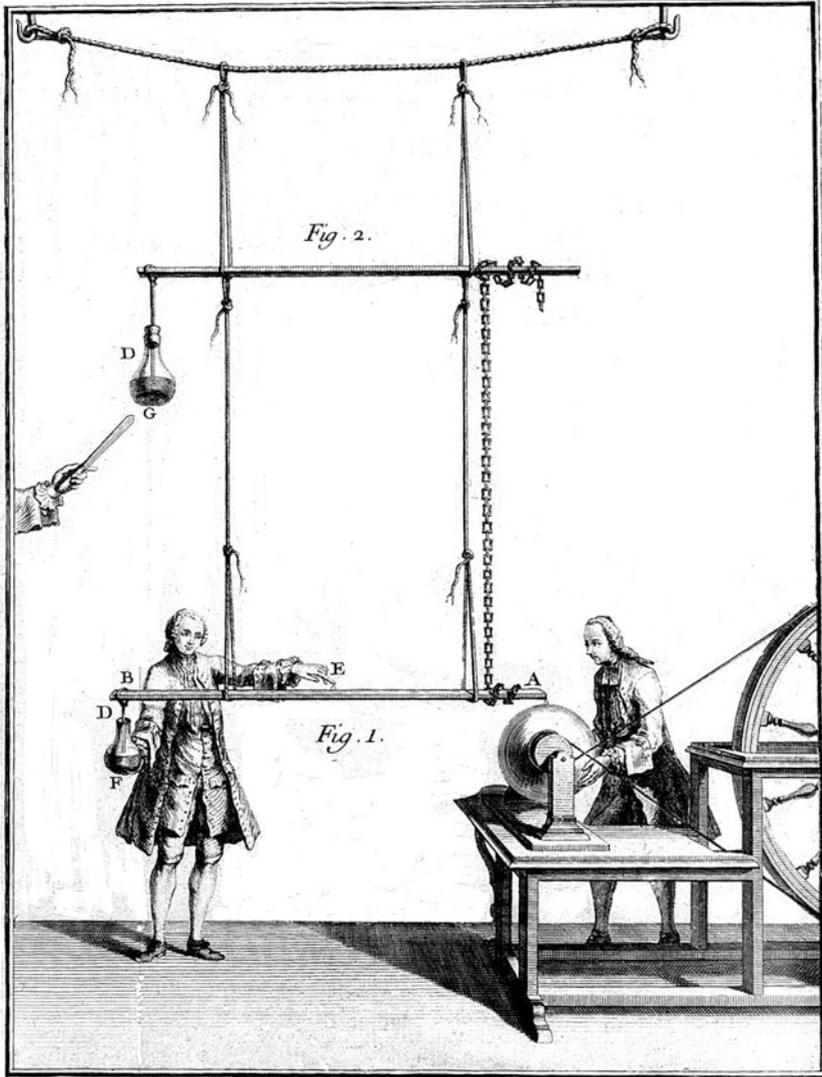


Fig. 1.1 Jean-Antoine Nollet, ‘Observations sur quelques nouveaux phénomènes d’Électricité’ (Paris, 1746).

‘electric fluid’, but also produce a series of spectacular effects, in which the human body is placed at the heart of the electric circuit. In experiment 31, Martin describes a person who while

standing on the [insulating] rosin holds a piece of money between his teeth, and the wire of the electrified phial with one hand; then if the person who holds the phial touches the money, the shock will be very sensibly [felt] in the teeth and head of the electrified person who holds it, and also to the other who touches it.³²

This incorporation into the experiment of the social interactions of exchange and theft, is followed immediately by an experiment in which two people are insulated and electrified ‘and then when the first person is thoroughly electrized, let them both incline their heads and salute each other, and the fire will join their lips when nearly touching, and give them a smart and mutual rebuff, which will make them separate more hastily than they joined’.³³ This ‘electrifying Venus’ experiment had been developed in Germany by Georg Matthias Bose, and as the *Gentleman’s Magazine* notes, produced surprise and delight that ‘such charming lips could set on fire a house’.³⁴ Martin, like his contemporaries, celebrates the participation of women in electrical experiments, but such experiments often become sexualised. As I discuss in [Chapter 3](#), in electrical displays and lectures and in many other sources, including erotica, the ‘electric fluid’ is celebrated as a quasi-material symbol of sexual attraction and repulsion.

Martin also includes a popular experiment in which an electrified person points his or her finger to ‘warm spirits of wine, and by communicating the electric fire thereto, kindles the rising fume’.³⁵ But his experiments do not only gesture to the outré delights of sex, alcohol and explosions. They also demonstrate the power of electricity to enable communication. He describes an experiment in which

the whole company join hand, or communicate with each other by wires; then the operator, or person who stands first, at one extremity of the line, hangs the electrized phial on the barrel, when the person at the other extremity draws off the spark from the barrel; and at that instant all the company receive the shock which they feel to their elbows and both their arms.³⁶

This is also a standard part of the demonstrator’s repertoire – the experiment had been pioneered by Bose, and in 1746, the year of Martin’s *Essay*, Jean Antoine Nollet, in the presence of King Louis XV, had ‘shocked 180

gendarmes . . . and over 200 Cartusians at their monastery in Paris'.³⁷ But Martin's group electrification produces a different emphasis from Nollet's use of courtiers and monks as props for the gratification of monarchy. Martin stresses that the 'whole company', male and female, should be involved, and this 'company' might well include a wide range of professional and social classes. Martin relates an incident in setting up a lecture when he was condemned by 'the rabble crouded about the door', for producing his 'Dul of a *Zbow*' for gentlefolk only, but, as he points out, his itinerant practice brings him into contact with people of all kinds, in contrast to Fellows of the Royal Society such as Freke.³⁸ In Chapter 4, I investigate texts which develop, and make explicit, Martin's suggestion of the democratic and potentially uncontrolled basis of electrical communication.

Martin ended his lecturing career in 1754, but continued to publish on electricity and other topics. His publications demonstrate his keen eye for the commercial exploitation of electricity, but also suggest how it complicated assumptions about who could undertake scientific enquiry. In 1759 Martin published *The Young Gentleman and Lady's Philosophy, in a survey of the works of nature and art: by way of dialogue*. The *Young Gentleman* was to form part of a broader project, Martin's *General Magazine of Arts and Sciences, Philosophical, Philological, Mathematical and Mechanical*, 'nothing less than a complete library of the arts and sciences, to be published in monthly parts'.³⁹ But the *Young Gentleman* proved by far the most popular part, reaching several editions.⁴⁰ It is a dialogue between Cleonicus, an undergraduate home for the holidays, and his sister Euphrosyne, during which Cleonicus instructs his sister in natural philosophy. As the status of its protagonists suggests, Martin's target audience appears to be the gentry, but this is nonetheless a non-specialist work: like Martin's lectures the *Young Gentleman* communicates the latest research in electricity to a wide audience.

Electrical experiments are an important element of the popularising drive of the *Young Gentleman*. Martin focuses on experiment rather than speculating on causes, though Cleonicus names Newton as the philosopher whose 'method of explaining these great effects is much preferable to any new hypothesis'.⁴¹ Martin demonstrates his familiarity with developments in electrical research since the publication of the *Essay* thirteen years earlier, but he does not dwell on these theoretical advances, focusing instead on the spectacular effects of electrical experiment. Cleonicus demonstrates a range of phenomena, and Euphrosyne's delighted, astonished reactions model those of an unlearned but intelligent audience.⁴² Cleonicus declares he

will explain ‘as much on that subject as I know of the matter myself, which, to say the truth, is not a great deal’, and at moments like this seems to stand in for Martin.⁴³

In the *Young Gentleman* theory is always paired with practice. Euphrosyne notes that as ‘the subject of electricity [is] such as I am so little acquainted with, that I scarcely know what to make of it, or how to fashion my intellects for understanding it, I must beg your assistance in this case, if possible, by experiment’.⁴⁴ Martin returns to many experiments featured in the *Essay*, but he gives a much more dramatic account of them than in the earlier work, because Euphrosyne’s responses are recorded in apparently real time. She is persuaded to draw off the spark from the machine, and declares:

Well! I did not think I was so faint-hearted. I find a strange reluctance to trying this experiment, tho’ there seems to be nothing in it. – Well! I’ll pluck up my courage and try. – Is my finger near enough now? – Dear me! It strikes before I was aware; but the sensation is rather agreeable than otherwise. – I can not take off as many sparks as I please, – and by continuing my knuckle near the barrel, I perceive a constant flame of purple fire flowing towards it. – These things are very wonderful as well as pleasant. I could not have thought there had been any such powers in nature.⁴⁵

Despite Euphrosyne’s apprehension, and her shock, the passage moves from uncertainty to pleasure, and a sense of greater understanding. Martin shows electricity to be an accessible, domestic science. Electrical equipment, especially Martin’s own, is clean, portable and suitable for ladies, and its spectacular effects can enable polite sociable exchange between the sexes.

But despite Martin’s emphasis on polite sociability, these demonstrations show their potential to overstep such forms. Cleonicus acknowledges that the electric stroke can be violent, particularly with the aid of the Leyden jar. He demonstrates the ‘electric circuit’ by shocking not only his sister, but also Chloe her lapdog. Though Chloe’s reaction is not recorded, Euphrosyne stands in: ‘Heavens! She’s gone, and I’m afraid has broke her neck in the fall – Poor little creature! How it cried out!’⁴⁶ Cleonicus then offers to render Euphrosyne’s ‘favourite linnet struck dead by the shock’, though he is persuaded to let a ‘little Titmose... be a substitute victim’, as Euphrosyne protests: ‘These scenes are so affecting, I could wish to have them changed for experiments of another sort.’⁴⁷

Cleonicus obliges, but reminds his sister that electricity ‘has killed a MAN, as effectually as a bird’, referring to the dangers of lightning.⁴⁸ Cleonicus notes that while defences against lightning have improved markedly, one effect has been to bring the world of powerful electric forces within domestic settings. One can be notified of the approach of the storm by a system of electrified warning bells which ‘may possibly salute your eyes and ears, at the same time you are sitting with [a gentleman] at the teatable’.⁴⁹ Martin emphasises Eurphrosyne’s delight and ‘wonder’ here, but his text makes the unmistakable suggestion that the electric fluid has the potential to violently infiltrate even domestic space.

Martin again evokes electricity’s resistance to control when he notes that it is often explained using a language of occult forces. Early on, Cleonicus notes ‘truly, my Euphrosyne, this is a kind of occult philosophy’, and this language recurs repeatedly. Euphrosyne praises the ‘merry scene’ of the display but then notes ‘Why this would pass for a sort of conjuration in countries where electricity has not been heard of.’⁵⁰ And in case Martin’s readers have not taken the hint, she repeats it:

On my word, *Cleonicus*, if you were to shew these experiments in some countries, with a black rod in your hand, and a three-corner’d cap, and a rusty furred gown on, they would certainly take you for a conjurer, and believe you had the art of dealing with the devil...for they could not possibly believe such things were to be done by the power of nature, as you now shew by this small machine.⁵¹

Cleonicus insists that these experiments are not the devil’s work but rather demonstrate the omnipotent power of God in creating such wonders. But the occult provenance of electrical effects is not so easily dismissed. Fara reads this incident as suggesting Martin’s conviction that ‘Witchcraft and wizardry might... be good enough as explanations for ignorant people, but not for those illuminated by the electric light of Enlightenment rationality.’⁵² But though Martin denies that occult powers are the source of electrical phenomena, his text does not make any positive claim for an alternative ‘rational’ cause. In the absence of such an alternative, suggestions of the occult properties of electricity live on not only in Martin’s text, but also in demonstrations and appropriations of electrical science throughout the century. As the experimenter William Watson declares in 1746, ‘this experiment will look much like magic, even to those who are acquainted with the operations of electricity’.⁵³

Though just one example of the ways in which electricity was discussed in the 1740s and 1750s, Martin's work emphasises some of the most important implications of electrical science at this moment. Martin conceives of electricity as a public, commercial science, but also as somatic, communicable and potentially violent, and perhaps most importantly, as a phenomenon that resists systematic theorisation about its causes, its effects and its utility, to the extent that it retains an occult status. It is these features of electricity, combined with its fashionable status, which mean that electrical discourse is remarkably well suited to figurative appropriation in a range of other discourses in the eighteenth century.

2 IMPONDERABLE FLUIDS

Martin was not the only commentator for whom the causes of electrical phenomena were opaque, but such opacity did not mean that electricity was unclassifiable by experimenters and philosophers. By the middle of the eighteenth century, they tended to class electricity as one of a range of 'imponderable fluids' alongside heat, light and magnetism.⁵⁴ As J. L. Heilbron notes, the model of imponderable fluids 'has not received high praise in retrospect'.⁵⁵ The existence of such fluids could not be proved by experiment, and commentators tended to evoke them as a catch-all solution for any form of obscure action or attraction at a distance. In the decades after 1750 in particular, Heilbron declares: 'The number of fundamental fluids became an embarrassment.'⁵⁶ In addition to its lack of specificity, the model of imponderable fluids looked like a philosophical throwback, and thus a further embarrassment to commentators who favoured a narrative of enlightenment and progress.⁵⁷ But as Heilbron notes, 'whether positive or negative, the influence of the scheme of the imponderables was pervasive'.⁵⁸ In this section I examine the ways in which electricity was classified alongside these other 'imponderables', and the empirical and figurative connections that were drawn between them. I also suggest the ways in which electricity frustrates efforts to classify it as just another 'imponderable fluid'. There are important distinctions between understandings of electricity and other 'imponderables', which offer clues as to the figurative appropriation of electricity in various discourses in the second half of the eighteenth century.

As Heilbron notes, imponderable fluids were conceptualised as a distinct kind of matter, 'weightless fluids, able to act on ponderable matter and in certain cases on one another', which 'served as carriers of special-purpose

forces' such as 'gravity, cohesion [and] chemical affinity'.⁵⁹ Not only did such a model offer an explanation for a wide range of mysterious phenomena, it also produced a reassuring ontology whereby it could be 'regarded as a model . . . of God's blueprint for the creation'.⁶⁰ The theological significance of models of imponderables derived from Isaac Newton's account of active forces in his *Opticks*, as I discuss in [Chapter 2](#). Heilbron identifies six fluids that 'gave rise to the phenomena of the physical world', namely forces of 'cohesion and affinity, and of heat, light, electricity and magnetism'.⁶¹ However, this was a loosely defined canon which 'easily accommodated' what Heilbron terms 'transient fellow-travellers – phlogiston, animal magnetism, animal electricity, radiant heat, to mention the most prominent'.⁶² The category of imponderable fluids was thus proliferative; its sketchily defined parameters and lack of empirical base meant that there was no limit to the phenomena that it might account for. Philosophical investigations into the forces of electricity and gravitation were thus aligned with the illegitimate or quack investigations of animal electricity and animal magnetism, as I discuss below and in [Chapters 3](#) and [4](#).

So what, precisely, was the relationship between these imponderable fluids? Tim Fulford who notes of animal magnetism that 'If it was not magnetism, and not electricity, it was analogous to them', is one of a number of commentators to suggest that the relation between different vital fluids was one of analogy.⁶³ As I discuss below, analogical reasoning was a legitimate epistemological method at this period in a range of scientific and philosophical endeavours. But theorists of imponderable fluids did not just use systematic analogous reasoning, but also a looser form of figurative connection. Fara notes that natural philosophers were 'relying on figurative vocabularies', on 'metaphorical thought: they were interpreting effects which had no visible causes, a power unfelt by the human body'.⁶⁴ Systematic analogies between imponderables thus shift into looser figurative connections. These unproven and unprovable connections were vital to all investigators of the imponderable fluids, but most particularly to those on the fringes of respectable investigation. Franz Anton Mesmer explained his pseudo-therapeutic animal magnetism, a form of psychological suggestion, using a model of imponderable fluids, moving from a 'literal application of magnets as therapeutic devices to a more metaphorical vision of a universal magnetic fluid', as I discuss in [Chapter 3](#).⁶⁵ Though Mesmer is commonly dismissed as a charlatan, as Riskin notes, his manipulation of figurative accounts of imponderable fluids was 'standard wisdom'.⁶⁶ The figurative connections between

imponderable fluids thus unsettled distinctions between legitimate and illegitimate practice, but this did not negate their use and utility at this period. Far from discrediting such claims, the figurative basis of the model of imponderable fluids induced natural philosophers to acknowledge the limits of their knowledge. As Heilbron notes, the key attitude in examinations of imponderable fluids was ‘modesty’: ‘its practitioners, when in a negative mood, agreed that it could not claim to a higher status than a convenient fiction’.⁶⁷ I try to pay attention to this ‘modesty’, to the way in which, for practitioners, the electric fluid might always understood as figurative, as an enabling medium for new readings not only of natural phenomena but also of cultural, social and political events.

As Heilbron and others have shown, understandings of electricity have much in common with those of other imponderables. But electricity stands apart in the radical nature of its figurativeness. Not only are metaphors and analogies used as tools to understand the nature of electricity at this period, but in addition, electricity itself becomes a figure for other inexplicable events. Fulford, Fara and others have shown that electricity is not the only imponderable fluid that assumes this figurative function. Magnetism and animal magnetism, for instance, are used for figurative representations of social and political phenomena.⁶⁸ But I suggest that figurative uses of the electric fluid are distinct from those of other imponderables. Fara has demonstrated in her study *Sympathetic Attractions* that images of magnetic connections stood in for a range of other obscure attractions:

Writers linked the sympathetic nature of magnetic activity with other relationships of attraction, such as the simultaneous maturation of wines and growing grapes or the ability of snakes to freeze their prey. Therapists tapped magnetic influences to guard against miscarriage or draw out the pains of gout, childbirth and toothache.⁶⁹

As Reil suggests, these magnetic forces were not far removed from the occult sympathies of Renaissance natural philosophy.⁷⁰ But such attractions were not merely understood as occult forms of connection. They were also assigned theological significance: ‘Compass needles represented the constancy of human souls irresistibly drawn to the divine center of attraction, while magnetic powers sympathetically bonded people to each other and to the rest of the universe.’⁷¹ Many of the features of Fara’s account of magnetism apply also to electricity. But Fara

herself distinguishes between the experimental practices of magnetism and electricity, and their figurative uses in other discourses.⁷² I suggest that electricity is distinguished by being associated not only with processes of attraction and cohesion, but also with acts of transmission and communication at this period.⁷³ The use of electrical images reflects uncertainty on the part of eighteenth-century commentators about the nature and the implications of such communication. Vital to its association with new, unprecedented and unexplained events is the mystery which persists at the heart of electrical science at this period, a mystery which complicates claims that by 1800 electricity was safely quantified and regulated.⁷⁴ Even into the 1820s the function of electricity is still represented as bafflingly and thrillingly opaque. It is not until the 1830s and the work of Michael Faraday, as I suggest in [Chapter 6](#), that with the quantification of electrical action, the figure of the fluid begins to lose its life, and the metaphorical basis of electrical science is altered.

3 ANALOGY AND METAPHOR

Accounts of imponderable fluids during the eighteenth century were informed, even structured, by figurative language and thought. The imponderable ‘fluid’ was itself a metaphor; the flow of liquid was the most apt way to describe the qualities of such an undetectable medium. But as Geoffrey Cantor has noted, it was often difficult to determine the moment at which propositions relating to fluids such as light and electricity, shifted between metaphorical and literal declarations.⁷⁵ The relationship between imponderable fluids was also understood to be figurative, namely analogical. Reasoning by analogy was a key element of empirical methods in natural philosophy at this period, sanctioned in the work of Francis Bacon and supported by a theological framework. But claims for the connections between such fluids were not always underpinned by systematic analogical relations, but rather seemed to employ a looser set of metaphorical associations. Here I investigate the use of reasoning by analogy in eighteenth-century natural philosophy, despite a wide-ranging protest against the use of figurative language in philosophical endeavours, and consider how scientific analogy might shift into less systematic figurative relations. Commentators’ use of such figures is particularly important in electrical discourse, as we have seen in the review of G. C. Morgan’s *Lectures*.

Figurative language had a contested status in empirical philosophy from the seventeenth century onwards, producing a distrust which

united commentators of widely differing views. In *Leviathan* (1651) Thomas Hobbes lists figurative expressions as one of the means through which men ‘deceive others’ in language.⁷⁶ And in his appendix to *An Essay Concerning Human Understanding* (1689), John Locke notes how figurative language is useful to ‘lay our thoughts before others with advantage and clearness’, but distinguishes the communicative practices of ‘rhetoricians and orators’ from the epistemological work of ‘philosophers and lovers of truth’:

Figured and metaphorical expressions do well to illustrate more abstruse and unfamiliar ideas which the mind is not yet thoroughly accustomed to; [however] such borrowed and allusive ideas may follow real and solid truth . . . but must by no means be set in its place, and taken for it.⁷⁷

For Locke, figurative language is something secondary and superficial, an ornamental layer that must be ‘penetrated’, as although it may decorate and even facilitate the communication of ideas, it is equally likely to obfuscate and obscure.⁷⁸

This distrust of figurative language was an important aspect of the procedures of the Royal Society in the seventeenth century. In his *History of the Royal Society* (1667), Thomas Sprat warns against the ‘pomp of words’, and insists that the Society is concerned instead with ‘real productions’, a position Jonathan Swift was later to mock in *Gulliver’s Travels* (1726).⁷⁹ The use of figurative language is a problem for the empirical methods of the Royal Society. Sprat does note that such language might be consistent with experiment; metaphors were once ‘an admirable instrument in the hands of wise men: when they were only used . . . to represent *truth* clothed with *bodies*; and to bring knowledge back again to our very senses, from whence it was at first derived to our understandings’.⁸⁰ Such figures were a means of emphasising the root of all knowledge in the evidence of the senses. But Sprat declares that men are now too concerned with the effects of their eloquence to attend to the empirical roots of the language. One aspect of ‘these specious *tropes* and *figures*’ disqualifies them entirely from empirical epistemology: ‘they give the mind a motion too changeable and bewitching, to consist with *right practice*’, and result only in ‘mists and uncertainties’.⁸¹ Sprat notes that such figures produce ‘motion’ in the mind. This conception of figurative images as in motion has been discussed at length by modern theorists of metaphor, who connect such motion with its epistemological function,

but Sprat condemns such uncontrolled signification.⁸² He insists on the regulation of language, noting that the Royal Society has resolved ‘to return back to the primitive purity and shortness, when men delivered so many *things*, almost in an equal number of *words*’.⁸³ Of course, Sprat’s resolution proves impossible to uphold; Tina Skouen and Ryan Stark point out the frequent use of metaphorical language in Royal Society publications, and note that its emphasis on collective, collaborative empirical investigation and ‘an open mode of communication’, ensured that rhetoric was ‘at the very heart of the scientific endeavor’.⁸⁴ But the Society’s distrust of the distance that figurative language placed between words and things, and the unsettling ‘motion’ that it gave to the mind proved influential for eighteenth-century thinking about metaphor and analogy, especially their utility in experiment.⁸⁵

Reasoning by analogy had a long history before the eighteenth century. Thomas Aquinas had argued for the analogical relations between every aspect of the universe as proof of God’s power as maker.⁸⁶ But in the seventeenth century analogy took on a new significance in increasingly secularised empirical philosophy. According to the inductive method of Francis Bacon, experimenters were to proceed from the evidence of their senses only. But, as Bacon explains in *The New Organon* (1620), in the event that sense data cannot provide experimenters with the necessary information, they are permitted to evoke one of a series of ‘privileged instances’ to aid their reasoning.⁸⁷ One set of such privileged instances is ‘*instances of supplement or substitution . . . They are the instances which supply information when the senses draw a total blank . . . either by degrees or through analogies.*’⁸⁸ Bacon notes that such acts of substitution are always a ‘last resort’, permissible only when the evidence of the senses fails. He reiterates the need to use ‘substitution by analogy . . . with discretion’, but notes that it can produce evidence ‘when a non-sensible thing is brought before the senses, not by sensible activity on the part of the insensible substance itself, but by observation of a related sensible body’.⁸⁹ Bacon thus builds comparisons between ‘sensible’ and ‘non-sensible’ phenomena into the heart of his empirical method. As Dahlia Porter notes, this made reasoning by analogy not just a problem-solving technique but a means of suggesting fundamental connections between a huge range of natural entities and even moral and aesthetic phenomena: ‘it created the sense that distinct objects of knowledge – emotions, mental operations, plants, and animals – were analogous to each other’.⁹⁰ Experimenters’ claims for analogous

relations between the imponderable fluids of heat, light, gravity, electricity and magnetism in one sense followed Bacon's suggestion of the use of analogy as the method of last resort. But it also suggested a reassuring, perhaps even theologically grounded system in which every aspect of the universe was ultimately connected to God.⁹¹

The theological basis of such reasoning by analogy, and the persistence of the scholastic model of divine analogy, is apparent in the work of Bishop George Berkeley. I discuss Berkeley's analogical method in his account of aether in more detail in [Chapter 2](#), but here I note the importance of reasoning by analogy in his work, and the ways in which analogy has the tendency to modulate from empirical tool to something more suggestive and less easy to control. As Fara notes, there were local, pragmatic reasons why Berkeley might insist on the importance of figurative reasoning in his work; it can be read as Tory polemic against the Royal Society.⁹² But more fundamentally, Berkeley sees analogy as a tool for understanding the relations between elements of the universe, and God.

In *Alciphron, or the Minute Philosopher* (1732) Berkeley stages seven dialogues between 'free-thinking' and Christian philosophers, designed to discredit the free-thinkers. In dialogue four it becomes clear that analogy is a crucial tool for thinking about the relation between God and the world, but when Berkeley first introduces the concept, he appears to advocate the sort of caution suggested by Bacon. Crito, Berkeley's speaker, notes that 'proper' analogy is 'a similitude of proportions' or ratio, which allows us to see the patterned structure of the universe and infer the design and presence of God.⁹³ And yet he observes that this proper use of analogy has the tendency to shift into a different kind of figurative relationship: 'although proportion strictly signifies the habitude or relation of one quantity to another, yet, in a looser and translated sense, it hath been applied to signify every other habitude; and consequently, the term analogy comes to signify all similitude of relations or habitudes whatsoever'.⁹⁴ Crito warns against this secondary use of analogy. He declares that 'a twofold analogy is distinguished by the schoolmen – metaphorical and proper'.⁹⁵ Crito gives several examples of the 'proper' use of analogy, but does not return to or offer any examples of 'metaphorical' analogy.⁹⁶ Rather, Berkeley leaves open the possibility that allegory might become metaphorical, and 'signify all similitude of relations or habitudes whatsoever'.⁹⁷

Berkeley merely hints at the shift from proportionate analogy into 'looser' metaphor in the fourth dialogue, but the seventh dialogue offers

a detailed example of this process. Euphranor discusses the way in which faith in God exceeds the evidence of our senses. He draws a comparison between acts of faith, and other examples in which the senses are insufficient to offer proof, and notes the importance of thinking imaginatively, and figuratively in both cases.

As the mind is better acquainted with some sort of objects . . . it seems naturally led to substitute those objects for such as are more subtle, fleeting, or difficult to conceive. Nothing . . . is more natural, than to make the thing we know a step towards those we do not know; and to explain and represent things less familiar by those which are more so . . . Hence figures, metaphors, and types. We illustrate spiritual things by corporeal; we substitute sounds for thoughts . . . Hence we speak of spirits in a figurative style, expressing the operations of the mind by allusions and terms borrowed from sensible thing . . . and hence those allegories which illustrate things intellectual by visions exhibited to the fancy.⁹⁸

Though Euphranor discusses faith, his claims for figurative reasoning here echo Bacon's account of analogy. This is problem solving by means of substitution, replacing the unfamiliar with the familiar. But Euphranor does not restrict his support for this reasoning to 'proper' or proportionate analogies but rather ranges freely between 'figures, metaphors and types' and even 'allegories'. Berkeley suggests that all these figurative structures might have an epistemological function; thus the knowledge-producing aspects of figurative terms are not limited to analogy in Berkeley's work. Analogy functions alongside metaphor and other figurative terms to 'illustrate things intellectual by visions exhibited to the fancy'. As I discuss in [Chapter 2](#), such figurative language is particularly important for Berkeley in discussing the qualities of the imponderable fluid of aether.

The tendency for analogy to slip into other forms of figuration is a problem for those who would fix meaning at this period. Samuel Johnson notes in the Preface to his *Dictionary of the English Language* (1755):

When the nature of things is unknown, or the notion unsettled and indefinite . . . the words by which such notions are conveyed, or such things denoted, will be ambiguous and perplexed . . . The original sense of words is often driven out of use by their metaphorical acceptations.⁹⁹

Johnson worries not only about the 'unsettled and indefinite' meaning of certain terms, but also about the proliferative effects of figurative

language, which in some cases has ‘driven out’ the literal sense of words altogether. But this does not seem to be a concern for investigators of imponderable fluids in general, and electricity in particular.¹⁰⁰ The distinction between literal language and figuration, be it analogy or something more ‘loose’, seems to be overcome time and again, to the extent that eighteenth-century electrical discourse perhaps gestures to the goal suggested by linguistically oriented historians of science, that we ‘entertain the notion that the literal and figural are part of a common linguistic field, and demand a simultaneous investigation’.¹⁰¹

Many electrical researchers, Martin among them, emphasise that they are working in a tradition of empiricist experimentation, after Bacon and Newton. Reasoning by analogy is thus a crucial aspect of their methodology, especially in the absence of sensory evidence of the phenomena they discuss. Electricians claim that both analogy and metaphor have an important epistemological function in their writings, and in doing so they not only echo Bacon and Berkeley, but also anticipate much more recent theories of metaphor and knowledge.¹⁰² However, in their more speculative writings, analogy slips into ‘looser’, more metaphorical figures. Experimenters and writers adopting electrical language even seem to relish the ‘unsettled and indefinite’ aspects of language that Johnson finds problematic. Electricity is deployed figuratively not just as an empirical ‘last resort’, but also to draw connections between apparently unrelated fields, to joke, to unsettle, and to persuade.¹⁰³ But as Martin’s work demonstrates, such is the uncertainty at the heart of electrical science during the eighteenth century that electrical discourse seems to disrupt the distinction between literal and figurative expression altogether.

The first epigram to this chapter is one of many examples of uncertainty over whether electricity is material or figurative. Ebenezer Kinnersley’s assurance that his electrical displays will demonstrate ‘Spirits kindled by fire darting from a lady’s eyes (without a metaphor)’ is complemented by Jacob Green’s suggestion in 1809 that people ‘observed to have a remarkably bright lustre of their eyes’ might be considered ‘strongly electrified naturally’.¹⁰⁴ Both echo the *Gentleman’s Magazine’s* declaration in 1745 that ‘ladies were sensible of this new privilege of kindling fires without any poetical figure or hyperbole’.¹⁰⁵ In all these cases, electricity appears to be an almost material manifestation of the erotic power of the female gaze. More broadly, these examples point to the way in which electricity seems to be conceived as a quasi-figurative phenomenon, which requires the use of figurative language to account for its operations. Electricity is not quite

figurative according to Kinnersley's account, but neither is it tangible and material. This status proves a real problem for commentators who would assign electricity a stable meaning, but enabling for those who make use of its proliferative, associative qualities.

The instability of electrical images perhaps threatens to negate arguments for their epistemological function. But I suggest that this instability not only makes electrical metaphors and analogies remarkably adaptable figurative categories, but also reveals certain characteristics of figurative expression itself. Recent studies of metaphor have noted that it engages the mind in motion, a statement that recalls Sprat's critique of figurative language in his *History of the Royal Society*.¹⁰⁶ The effects of metaphor too are proliferative, or contagious. Laura Otis notes that 'Metaphors are "catchy", among the most infectious associations language offers.'¹⁰⁷ Such insights can help us think about the function of electrical images. Many eighteenth-century commentators refer to electricity as a 'contagion', but electricity is distinguished from mere disease in important ways. In the second epigram to this chapter, Percy Bysshe Shelley claims that the language of poets 'is vitally metaphorical; that is, it marks the before unapprehended relations of things and perpetuates their apprehension'.¹⁰⁸ Shelley makes the familiar claim that figurative language enables connections between concepts whose 'relations' were previously 'unapprehended'. But he uses a version of an electrical metaphor in order to make this claim. In vitalist theories of life, electricity is often considered to be a quasi-material 'vital spirit', as I discuss in [Chapters 4 and 5](#). Here Shelley makes metaphor take the place of that vital spirit; it can be considered the life force of language. In Shelley's image we see a distinction between images of contagion, and of electricity. Electrical images emphasise the tendency of metaphorical language itself to proliferate, but they also emphasise that such proliferation can be considered the 'life force' of language itself. The vital qualities of electricity form a significant part of my analysis throughout this book, as many commentators at this period intuit the connection between electricity and vitality, and suggest that electricity's vital function is linked with its indeterminate, quasi-figurative status.

We can read electrical images as a category of figurative communication that makes visible its, at times, unstable proliferative qualities, but that can also 'vivify' language itself. Electrical images were used in the eighteenth century to find a language to describe unprecedented cultural, social and political concerns. Brad Pasanek argues that 'Metaphors are slippery,

devious' and therefore difficult to assign a stable ideological function.¹⁰⁹ But what sets electrical images apart, is the way that they signal and comment upon their own semantic slipperiness and ideological uncertainty. The self-consciousness with which writers employ such images reveals much not only about contemporary conceptions of electricity, but also about the fraught status of concepts for which electricity seems the most appropriate image. The ease with which electric images move between the discourses of 'science', literature and politics during the eighteenth century testifies to the more fluid status of the disciplinary distinctions between them during the eighteenth century, and to some extent to this day. This study incorporates elements of cultural histories of science, and histories of political discourse, into its formal analysis of diverse eighteenth-century written expression; as images of electricity remind us, we should look for the common ground between these categories.

NOTES

1. 'An historical account of the wonderful discoveries', 193. This article was the work of Albrecht von Haller. Tucker, *Bolt of Fate*, 324.
2. Davy, 'Historical sketch of electrical discovery' (1810), in *Collected Works*, vol. VIII, 263. Davy's is just one of many histories of electricity produced during this period. Others include Priestley, *History and Present State of Electricity*, and Lofft, *Eudosia*.
3. Adams, *Essay on Electricity*, 11. See also Sha, 'From Electrical Matter', 144.
4. Schaffer, 'Natural Philosophy and Public Spectacle', 6–10; Stewart, *Rise of Public Science*, 104.
5. Wylie, *Young Coleridge*, 129; Heilbron, *Electricity*, 67–70.
6. Burke, *Select Works*, vol. III, 186.
7. I have found Raymond Williams's 'structures of feeling' useful for thinking about how electrical language enables writers to articulate otherwise inarticulable characteristics of their lived experience. Williams, *Marxism and Literature*, 128–135.
8. Olson, *Scottish Philosophy*, 171.
9. Leslie, 'Lectures on Electricity', 28.
10. *Ibid.*
11. Morgan, *Lectures on Electricity*, vol. I, iv–v.
12. Leslie, 'Lectures on Electricity', 29.
13. Schaffer, 'Consuming Flame'; Fara, *Entertainment for Angels*; Bertucci, 'Sparks in the Dark'; Bertucci and Pancaldi (eds.), *Electric Bodies*; Delbourgo, *A Most Amazing Scene*; Riskin, *Science in the Age of Sensibility*.

14. Keen, *Crisis of Literature*, 1–4; Klancher, *Making of English Reading Audiences*, 10–11.
15. Freke, *Treatise*, 140. See also Millburn, *Benjamin Martin*.
16. Priestley, *History*, 86–87. See also Delbourgo, *A Most Amazing Scene*, 4; Watson, *A Sequel*, 64.
17. Millburn, *Benjamin Martin*, 52–53.
18. Martin, *Essay on Electricity*, 5.
19. *Ibid.*, 6.
20. Millburn, *Benjamin Martin*, 53.
21. Martin, *Essay on Electricity*, 6.
22. Stewart, *Rise of Public Science*, 119.
23. Newton, *Opticks*, 340–341.
24. Martin, *Essay on Electricity*, 8–9.
25. Franklin, *Benjamin Franklin's Experiments*, 203.
26. Martin, *Essay on Electricity*, 9, 11.
27. *Ibid.*, 18–19.
28. *Ibid.*, 20–21.
29. *Ibid.*, 19.
30. Freke, *Treatise*, 138.
31. Fara, *Sympathetic Attractions*, 18
32. Martin, *Essay on Electricity*, 36.
33. *Ibid.*
34. 'An historical account of the wonderful discoveries', 193; see also Bertucci, 'Sparks in the Dark', 91.
35. Martin, *Essay on Electricity*, 37.
36. *Ibid.*
37. Heilbron, *Electricity*, 316.
38. Martin, *Supplement*, 29; See also Millburn, *Benjamin Martin*, 40.
39. Millburn, *Benjamin Martin*, 68.
40. *Ibid.*, 74.
41. Martin, *Young Gentleman and Lady's Philosophy*, vol. I, 297.
42. *Ibid.*, 301.
43. *Ibid.*, 300.
44. *Ibid.*, 303.
45. *Ibid.*, 305.
46. *Ibid.*, 311.
47. *Ibid.*, 311–312.
48. *Ibid.*, 322. Cleonicus refers to the death of Professor Richmann in St Petersburg in 1753; see also *ibid.*, 327.
49. *Ibid.*, 324.
50. *Ibid.*, 301, 309.
51. *Ibid.*, 316.

52. Fara, *Pandora's Breeches*, n.p.
53. Watson, *A Sequel*, 41.
54. Schaffer, 'Consuming Flame', 496; Home, 'Electricity and the Nervous Fluid', 241; Heimann, 'Ether and Imponderables', 61. Richard Sha suggests a shift to concepts of electricity as a fluid from earlier notions of 'fire' as exemplified in Freke's account. Sha, 'From Electrical Matter', 143.
55. Heilbron, *Weighing Imponderables*, 7.
56. Heilbron, *Electricity*, 70.
57. Reill, 'The Legacy', 33.
58. Heilbron, *Weighing Imponderables*, 7.
59. *Ibid.*, 5. This model transcended disciplinary distinctions in natural philosophy, as Jan Golinski notes. Golinski, 'Chemistry', 388.
60. Heilbron, *Weighing Imponderables*, 5. Geoffrey Cantor discusses how this was at times an uneasy connection. Cantor 'Weighing Light', 130–131.
61. Heilbron, *Weighing Imponderables*, 6–7.
62. *Ibid.*, 16.
63. Fulford, 'Conducting the Vital Fluid', 63; Heilbron, *Weighing Imponderables*, 14, 16. Heilbron's key example is the relation between electricity and the imponderable fluid of heat, caloric. *Ibid.*, 10–13.
64. Fara, *Sympathetic Attractions*, 176–177.
65. Fara, 'Marginalized Practices', 491.
66. Riskin, *Science in the Age of Sensibility*, 198.
67. Heilbron, *Weighing Imponderables*, 17. See also *ibid.*, 19, 21, 22; Sha, 'From Electrical Matter', 143.
68. Fulford, 'Conducting the Vital Fluid'; Fara, *Sympathetic Attractions*.
69. Fara, *Sympathetic Attractions*, 6.
70. Reill, 'The Legacy', 33.
71. Fara, *Sympathetic Attractions*, 4.
72. *Ibid.*, 7, 18–20.
73. Sha, 'From Electrical Matter', 145.
74. Heilbron, *Weighing Imponderables*, 1–4.
75. Cantor, 'Weighing Light', 128.
76. Hobbes, *Leviathan*, vol. II, 50.
77. Locke, *Essay Concerning Human Understanding*, 298.
78. See also *ibid.*, 40.
79. Sprat, *History of the Royal Society*, 62; Swift, *Gulliver's Travels*, 271–272. See also Skouen and Stark, 'Introduction', 20.
80. Sprat, *History of the Royal Society*, 112.
81. *Ibid.*, 112. See also Golinski, 'Robert Boyle', 64–65; Stewart, *Public Science*, xx–xxi.
82. Richards, *Philosophy of Rhetoric*; Lakoff and Johnson, *Metaphors We Live By*; Black, *Models and Metaphors*; Blumenberg, *Paradigms for a Metaphorology*;

- Derrida, 'White Mythology'; Ricœur, *The Rule of Metaphor*; Fogelin, *Figuratively Speaking*; Boyd, 'Metaphor and Theory Change'.
83. Sprat, *History of the Royal Society*, 113.
 84. Skouen and Stark, 'Introduction', 2, 14–15. See also Dear, 'Totius in Verba'; Vickers, 'The Royal Society', 9.
 85. The Royal Society's edict against figurative language continues to inform the perceived differences between scientific discourse and other forms of cultural expression. Christie, 'Introduction', 3; Fara, *Sympathetic Attractions*, 173–174.
 86. Kahn, *Rhetoric, Prudence and Scepticism*, 48.
 87. Jardine and Silverthorne, 'Introduction', xxii.
 88. Bacon, *New Organon*, 180.
 89. *Ibid.*, 180–181.
 90. Porter, 'Scientific Analogy', 216.
 91. Reill, 'The Legacy', 38.
 92. Fara, *Sympathetic Attractions*, 172.
 93. Berkeley, *Alciphron*, 111.
 94. *Ibid.*
 95. *Ibid.*
 96. This distinction between analogy and metaphor is often found in modern philosophical accounts of the terms. See, for instance Botha, *Metaphor and its Moorings*, 91, 93.
 97. Myers, 'How Body Matters', 123; Law, *Rhetoric of Empiricism*, 102–104.
 98. Berkeley, *Alciphron*, 138–139.
 99. Johnson, 'Preface', *Dictionary*, vol. I, n.p. See also Fara, *Sympathetic Attractions*, 171. Gillian Beer notes a similar pattern in nineteenth-century scientific writings. Beer, *Darwin's Plots*, 5, 82–83.
 100. Fara, *Sympathetic Attractions*, 174–175.
 101. Christie, 'Introduction', 4.
 102. Stafford, *Body Criticism*, 17; Otis, *Networking*, 12, 47–48; Winter, *Mesmerized*; Fara, *Sympathetic Attractions*, 174.
 103. Fara makes similar claims for magnetic discourse. Fara, *Sympathetic Attractions*, 30. See also *ibid.*, 151.
 104. Kinnersley, *Pennsylvania Gazette*, 18 April 1751; Green, *Epitome of Electricity*, 55–56.
 105. 'An historical account of the wonderful discoveries', 194.
 106. Davidson, 'What Metaphors Mean', 31–47.
 107. Otis, *Networking*, 4. See also Mitchell, *Contagious Metaphor*.
 108. Shelley, *Shelley's Poetry and Prose*, 482.
 109. Pasanek, 'Eighteenth-Century Metaphors of Mind', 30.

Experiment, Aether and the Soul of the World

In his *System of Familiar Philosophy* (1799), Adam Walker, author, lecturer and demonstrator in electricity, declares of the ‘electric fluid’:

Its power of exciting muscular motion in apparently dead animals, as well as of . . . reviving diseased vegetation, prove its relationship or affinity to the *living principle*. Though Proteus-like, it eludes our grasp; plays with our curiosity; tempts enquiry by fallacious appearances, and attacks our weakness under so many perplexing subtilities [sic]; yet it is impossible not to believe it the soul of the material world, and the paragon of elements!¹

Walker’s declaration, especially his enthusiastic closing remarks, seem out of character for an empiricist and materialist who makes no public avowals of religious faith. But Walker’s use of a mystical force, ‘the soul of the material world’, to account for electrical phenomena follows a long and varied discussion of the relationship between electricity and immaterial spirits, which first takes shape in the 1740s, and in which electricity raises important and troubling questions about the nature of matter and of the soul. In this chapter I examine a series of works in which questions over the nature of experimental methods, hypothesis and speculation are brought to bear in electrical experiments that persistently evoke the presence of God. Experimenters employ the concepts of ‘anima’ or soul, and ‘aether’ to account for electrical phenomena, and

such use of spiritual terms raises further debate about the distinction between material and immaterial existence, and the function of faith in experimental endeavour. These texts demonstrate how discussions of electricity are never confined to philosophical or scientific matters, but are deployed, often polemically, in discussion of religious, cultural and even political beliefs.²

Walker's work is an important example of the changes in conceptions of electricity, and of understandings of matter and spirit, over the course of the century. His description of electricity as a material phenomenon, but also the 'soul of the material world' in 1799 contrasts with discussions of the soul in the early part of the century. In his *Enquiry into the Nature of the Human Soul* (1733) Andrew Baxter set out to prove the soul's immateriality. This was a pressing issue given recent demonstrations of 'imponderable' fluids like electricity and gravity, which suggested previously unapprehended relations between matter and spirit.³ Baxter at first admits that we cannot prove the soul is immaterial, defining it merely as 'that which is active and percipient in us . . . whatever be the substance of it; whether material or immaterial'.⁴ But he soon hardens his position, declaring that the soul must be immaterial, because it has powers of motion, in contrast to matter, which only reacts, and resists. Matter is 'void of all power', it displays only 'a *vis inertiae*, as it were, a negative activity . . . stubborn inactivity'.⁵ Baxter's was a commonly held position, which insisted on the lifelessness of matter, and the need for an external, perhaps divine, moving and vitalising force.⁶ His claims for the inertia of matter are placed under pressure by the evidence of electrical phenomena, but he insists that such 'tendencies to motion . . . observed in matter, are not powers implanted in matter, or possible to be made inherent in it; but (therefore) impulse, or force impressed upon it *ab extra*'.⁷ These phenomena are not examples of matter in motion, but rather of forces imparted to it. To explain this process Baxter employs a familiar model, that of 'some fluid, or very subtle matter'.⁸ In contrast to commentators who hint at the immaterial nature of 'imponderables', for Baxter this 'fluid' is just another example of lifeless matter.

*the powers of gravity, elasticity, repulsion, attraction, can be no more lodged in the matter of this fluid than in the matter of the real bodies we have been speaking of. . . We must still seek a cause of its motion ab extra to it . . . something not matter, in some immaterial cause, or being.*⁹

The ‘cause’ of such phenomena is the ‘*immaterial, powerful Being, who first made this dead substance matter, originally impressed and still continues to impress motion upon it*’.¹⁰ Baxter’s account of inert matter thus forms the basis of his claims for an immaterial soul and the constant intervention of God in the workings of the universe: ‘To begin with examining the work of matter, and shewing its *inactivity*, makes the shortest work with Atheists of all denominations.’¹¹ But despite the apparent ease with which Baxter dispatches ‘Atheists’, his claims for an immaterial soul are complicated and challenged in subsequent writings on electricity, matter and spirit.

Theories of the operations of electricity profoundly unsettle arguments for a dichotomy between material and immaterial phenomena. Sir Isaac Newton’s account in his *Opticks* (1704–1718) of a ‘subtile, elastic’ fluid or aether, which pervades the universe, and which seems to be evidence of divine power in nature is in part an effort by Newton to discredit mechanical models of the universe.¹² But the *Opticks* provoked a vast array of responses and appropriations, some of which worked against Newton’s claims, and proved particularly important for researchers in electricity.¹³ Bishop George Berkeley objects to the perceived mechanism of Newtonian natural philosophy, and attempts to reassert the spiritual provenance of aether, using ancient models of ‘the soul of the universe’. While neither Newton nor Berkeley explicitly connects these aethereal forces with electricity, during the huge increase in experimentation and speculation in the 1740s many experimenters claim aether as the cause of electrical phenomena. I assess the afterlife of this discourse of electrical aethers in the work of Benjamin Franklin and his associates. Franklin is often claimed as a Newtonian thinker, but he rejects the language of aether in his writings on electricity, in favour of a more secular set of references. Franklin’s practice forms an important contrast with that of his collaborator Ebenezer Kinnersley, a former Baptist minister who is more open to the possibility of the operation of immaterial spirits, and who utilises this openness in his experimental practice. Joseph Priestley, the first declared historian of electrical science, but also an experimenter, theorist and Protestant dissenting minister, changed the terms of the debate over the spiritual qualities of electricity. Priestley argues for a new account of active matter, an intervention informed by his and others’ research on electricity. Priestley’s work is taken up by Adam Walker, with whom I began, and with whom I close the chapter. Walker shows how keeping open the possibility of the spiritual provenance of electricity might enable electricians to turn their findings to polemical use, protesting against the abuses perpetuated by the powerful.

Heilbron declares in his account of secularising advances in eighteenth-century physical sciences that electrical experimentation was ‘theologically and cosmologically neutral’ at this period.¹⁴ I suggest, rather, that theological discussions are fundamental to both the theorisation of the electrical fluid and the cultural practices of electrical experimentation and display. Even the most commercially savvy of electrical experimenters noted electricity’s religious resonance. The *Gentleman’s Magazine* of April 1745 describes an infamous experiment by Georg Matthias Bose, named the ‘beatification’.

They set about electrifying the person prepared for the solemnity, or destin’d to the apotheosis. In a little time, a glimmering light of a gold colour arises from the pitch . . . [it] at last reaches the head, and encompasses the whole person with a *glory*, which is a lively representation of that border of light which adorns the pictures of saints.¹⁵

The *Gentleman’s* responds sceptically to this apparently miraculous occurrence, observing: ‘Very skilful naturalists have not been able to succeed, when they have attempted to beatify, as M. Bose expresses it.’¹⁶ And Bose’s beatification was eventually discredited, revealed as ‘a mere trick’, as Priestley notes in his *History and Present State of Electricity*:

[Bose] candidly acknowledged that he had made use of a suit of armour, which was decked with many bullions of steel . . . and that when the electrification was very vigorous, the edges of the helmet would dart forth rays, something like those which are painted on the heads of saints. And this was his boasted beatification.¹⁷

For Priestley, the invocation of miracles discredited the empirical basis of electrical investigation and rational faith. But not all electrical experimenters treated the invocation of the divine as a misleading distraction. Theological discourse enabled electricians to make the case for God’s presence not only as the first cause of life and motion in the universe, but also as an active presence in the natural world.

Baxter argues that electricity and gravitation are material phenomena, which require an immaterial power *ab extra* to produce motion. But for many experimenters, following Newton, the causes of such phenomena were ‘active principles’, a set of loosely defined forces which as P. M. Heimann notes were understood as ‘the manifestations of divine agency

in nature'.¹⁸ Such 'active principles' differ from Baxter's immaterial forces '*ab extra*'. They are special properties of matter that nonetheless sustain their divine origin. However, the use of the model of 'active principles' to explain electrical phenomena threatened to produce similar consequences to the capacious model of 'imponderable fluids' discussed in [Chapter 1](#). As Schaffer notes, electrical displays were claimed as 'evidence of the immanence of divine power in the natural world'. But the 'identification of electricity with fire or with chemical activity, with phlogiston, light or nervous fluid, formed part of a practice in which it was essential to connect powers with divine action and then produce them from matter'.¹⁹ On one hand the model of active principles offered a divine origin for electrical phenomena. But on the other it perpetuated the problem of explanatory models that were so broad as to become meaningless. Electricians who evoked 'active principles' did not attend to the figurative nature of the model, which is more clearly signalled in discussions of imponderable fluids. Rather they leaped from hypothesis to fact and overlooked the fact that their existence was unproven. This was especially true for commentators who connected electricity with 'aether', sometimes understood as an active principle and sometimes as an imponderable fluid. As Fara notes, 'electrical aethers proliferated. . . And many were so nebulously defined that it is hard to determine what their authors meant'.²⁰ This chapter examines diverse examples of the category of 'electric aether'. Varied though these aethers were, they had important elements in common. Experimenters based their claims for the existence of electrical aethers on the work of Newton; aether theories could not be experimentally proved, but as a result they sustained the possibility that there was an 'active' divine aspect to the phenomena of electricity.

1 ISAAC NEWTON

Newton's work is the basis for aethereal models of electrical phenomena, and for the suggestion that divine 'active principles' are at work in nature.²¹ Newton is a figure of authority for electrical experimenters, not only for his philosophical reputation but also for the way in which his work enables claims for the active intervention of God in electrical phenomena.²² But his account of the vagaries of such phenomena complicates this authority, as electricity's wondrous qualities and obscure operations demonstrate that not even Newton could account for all natural phenomena. The key Newtonian text for electrical experimentation is not the

Principia (1687), a Latin treatise in which he offers the mathematical formula for the operation of gravity, but the *Opticks*, a speculative text in English, which displays Newton's experimental skills, but which offers few answers about the operation of light. Newton concludes the *Opticks* with a series of queries that, however rhetorically, open up new questions about the operation of the aether.²³ Newton undercuts his own authority in the *Opticks*, by refusing to categorically state details of aether, its causes and effects.

In query 8 of the first edition of the *Opticks* (1704), Newton suggests that aether is a medium for heat, but its effects extend far beyond a domestic or even a terrestrial setting: 'is not this Medium exceedingly more rare and subtile than the Air, and exceedingly more elastick and active? And doth it not readily pervade all Bodies? And is it not (by its elastick force) expanded through all the Heavens?'²⁴ Here, as Heimann suggests, Newton seems to align the aether with divinely produced 'active principles' but such a connection is 'bedevilled by ambiguities'.²⁵ In query 21, Newton discusses the aether in more detail, asking, 'Is not this Medium much rarer within the dense bodies of the Sun, Stars, Planets and Comets, than in the empty celestial Spaces between them?' But despite this increased specificity, he notes in the same query, 'I do not know what this *Aether* is'.²⁶ While Newton speculates about aether's operation, he does not offer an explicit account of its provenance. However, the queries do offer several hints at the connection between aether and electricity, which are enthusiastically taken up by electrical experimenters. Newton notes:

If any one would ask how a Medium can be so rare, let him tell me . . . how an electrick Body can by Friction emit an exhalation so rare and subtile, and yet so potent, as by its Emission to cause no sensible diminution of the weight of the electrick Body . . . and yet be able to agitate and carry up leaf Copper, or leaf Gold, at the distance of above a Foot from the electrick Body?²⁷

He thus suggests that electricity is a visible, tangible example of the operation of the aether. The potential influence and range of such electrical aether is enormous; it might operate by the 'Foot', or through the infinite reaches of space.²⁸

The queries to the *Opticks* were not Newton's first published account of a subtle, elastic aether, and not the first time he had connected aether

with electricity. The final paragraph of the General Scholium of the English translation of the *Principia* (1729) describes

a certain most subtle spirit which pervades and lies hid in all gross bodies; by the force and action of which spirit the particles of bodies attract one another at near distances . . . and electric bodies operate to greater distances . . . But these are things that cannot be explained in a few words, nor are we furnished with that sufficiency of experiments which is required to an accurate determination and demonstration of the laws by which this electric and elastic spirit operates.²⁹

Newton's characterisation of aether in the *Opticks* seems a development of these remarks, but there are also important distinctions between them. Here Newton makes a more explicit connection between electricity and aether than we find in the *Opticks*. Not only is electricity evoked as an example of the operation of aether, but also aether is described as 'this electric and elastic spirit'. This is a striking statement, despite Newton's caveat that the provenance of aether cannot be experimentally tested and is therefore uncertain. In fact, Newton did not include the words 'electric and elastic' in the Latin text of the *Principia*; they were added to the 1729 edition by the translator Andrew Motte.³⁰ But in unpublished drafts of the *Principia* and the *Opticks*, Newton did align the aether with the 'electric fluid'.³¹ While in the *Opticks* Newton describes an 'aethereal medium', in the *Principia* he names a 'certain most subtle spirit'. 'Spirit' has connotations which 'medium' does not, but these connotations are again ambiguous. For Heimann Newton's use of spirit seems to signify 'a substance intermediate between passive matter and the higher spiritual entities', whereas for R. W. Home it 'does not mean . . . that he regarded it as some kind of immaterial agency' but rather something of a 'material nature'.³² Thus Newton suggests that aether might have an immaterial and divine rather than material cause, but makes no kind of categorical statement.

In the *Opticks*, Newton dilutes both his association between electricity and aether, and the suggestion of aether's divine provenance. This perhaps arises from his insistence that natural philosophical analysis 'consists in making experiments and observations, and in drawing conclusions from them by induction, and admitting of no objections against the conclusions, but such as are taken from experiments, or other certain truths'.³³ Newton's emphasis on experimental proof places pressure on claims for the active presence of God in the natural world. He declares that the work

of the philosopher is ‘is to argue from phaenomena . . . and to deduce causes from effects, till we come to the very first cause’, but the activity of this first cause, cannot be experimentally tested.³⁴

Newton’s personal faith has been the subject of much discussion. While Heimann argues that for Newton ‘the laws of nature are . . . imposed on nature by God’, I. B. Cohen asks of the queries to the *Opticks*, ‘is God an hypothesis in Newton’s experimental philosophy?’³⁵ Cohen retreats from this suggestion, pointing to the declaration of faith in query 31, in which Newton insists, as Baxter was later to do, that matter exhibits a *vis inertiae*, and that motion must therefore arise from ‘active principles’.³⁶ Newton presents these active principles as agents of God, but does not offer an account of their operation. He can make only the negative assertion that they are not ‘occult properties’ which ‘put a stop to the improvement of natural philosophy’, but rather ‘general laws of nature by which things themselves are formed: their truth appearing to us by phaenomena, though their causes be not yet discovered’.³⁷ The causes of active principles may be obscure, but as an experimentalist, Newton can reason from the evidence of their effects.³⁸ He declares that the uniformity of the universe ‘can be the effect of nothing else than the Wisdom and skill of a powerful ever-living Agent’.³⁹ But his refusal to speculate about the means through which God acts, ensures that many unanswered questions remain about the nature and properties of the active spirits, and aether’s relationship to them, and to the ‘electric fluid’. As Heilbron suggests, it is not clear whether ‘active principles’ are agents of God, and if so, whether they are ‘physical agents’.⁴⁰ And one interpretation of Newtonian active principles suggested that matter might be the source of its own motion without the presence of God. As Marina Benjamin suggests, in this model ‘The activity of nature was . . . explained in terms of the material operations of an aethereal medium, and Providential intervention became redundant.’⁴¹ The apparently self-moving qualities of electrical ‘matter’ seems to corroborate suggestions that aether is an active principle. Despite Newton’s prescriptions against reasoning from effects to occult causes, the conceptual lacunae in his own accounts of active powers and aethereal matter enabled electrical experimenters to speculate wildly while claiming Newton as an authority.⁴²

As Benjamin notes, in the decades following the publication of the *Opticks*, electrical phenomena ‘were represented as manifestations of active powers in matter, since electricity was itself identified with an aethereal principle’.⁴³ Peter Collinson, Fellow of the Royal Society, wrote in 1745:

electricity . . . may lead to higher truths, in particular to discover the nature of that subtle elastic and aethereal medium which Sir Isaac Newton queries on at the end of his *Opticks*; had these discoveries happened in that great man's time, his illuminated mind would have applied them to wonderful purposes.⁴⁴

As Schaffer notes, this association between electricity and Newtonian aether was useful for electrical experimenters for both philosophical and commercial reasons.⁴⁵ But Newton's cautious conceptualization of active principles and the aether did not provide definitive claims for the causes of these phenomena, or by extension electricity.⁴⁶ The poet Christopher Smart, who disagreed with Newton's conception of aether as a mediator of God's active presence, nonetheless claimed electricity as evidence of God's direct intervention in the universe.⁴⁷ Smart declares in the section of *Jubilate Agno* in praise of his cat:

For by stroking of him I have found out electricity.
 For I perceived God's light about him both wax and fire.
 For the electrical fire is the spiritual substance which God sends from heaven to
 sustain the bodies both of man and beast.⁴⁸

As Brian Gibbons notes, despite Smart's intermittent madness, 'there was nothing particularly eccentric about the electrical theology underlining this passage'.⁴⁹ Smart's claim for electricity as the direct agent of God rather than an intermediary is rare. But it shows how the provenance of electricity remained obscure even when associated with Newtonian aether. Electricity might be an aethereal medium for an active principle, or perhaps that active principle itself; it might thus be, in Newton's terms, an immaterial 'aethereal spirit', or conversely that principle in matter which vivified the *vis inertia* and made intervention from God unnecessary. Thus as Fara notes, although aethereal theories of electricity 'offered a reasonable account of how Christian dualism and electrical theory could be reconciled', they also sounded 'dangerously like the mechanical models of materialists who, because they attributed attractive and repulsive powers to matter itself, were often denounced as atheists'.⁵⁰ One of the most detailed responses to this threat of a mechanical theory of the universe, and most thorough attempt to revitalise a spiritualised account of matter, was George Berkeley's *Siris* (1744).

2 GEORGE BERKELEY

Berkeley's, *Siris: a chain of philosophical reflexions and inquiries concerning the virtues of tar water* is a medical text, prescribing the use of tar water as a universal panacea. That panacea operates through the influence of an aether, fire, or the soul of the world diffused through the universe. In making these claims Berkeley sets out his objections to a mechanised model of the universe, which he sees as derived from Newton's work, and insists instead on God's direct interventions.⁵¹ But despite Berkeley's objections to Newton's work, *Siris* has much in common with the *Opticks*. Though Berkeley does not discuss electricity, *Siris* is an important addition to the discourse of aethereal fluids employed by theorists of electricity, because he emphasises the theological significance of such fluids. Unlike Newton, who does not discuss the nature of the soul, Berkeley declares that aether is the soul of the world, or *anima mundi*.

Berkeley claims that tar draws a certain acid from water which is infused with vivifying active principles, characterised variously as light, fire, aether, and even anima. *Siris* is not a systematic work, and Berkeley draws on a range of associations and analogies between the various active principles, keeping open the possibility that those connections might be purely figurative. In contrast with Newton, he insists that active principles are immaterial, and agents of a divine power. Berkeley's account of fire seems to be indebted to Herman Boerhaave, a Dutch chemist and physician, but in contrast to Boerhaave for whom fire was a material substance, Berkeley's 'active substance' is always immaterial.⁵²

This Aether, or pure invisible Fire, the most subtle and elastic of all bodies, seems to pervade and expand itself throughout the whole universe . . . This mighty agent is everywhere at hand, ready to break forth into action, if not restrained and governed with the greatest wisdom . . . So quick in its motions, so subtle and penetrating in its nature, so extensive in its effects, it seemeth no other than the Vegetative Soul, or Vital Spirit of the World.⁵³

Here Berkeley names a range of active principles: aether, fire, soul and vital spirit. He aligns aether and fire, terms that are often interpreted as having a material basis, with those perceived as immaterial like spirit and soul, and he implies that all have an active, restless qualities, a suggestion that is taken up in the later work of Ebenezer Kinnersley and Adam Walker. Like Newton, Berkeley interprets this spirit as the agent of God; it is not the first cause of

motion, but the medium through which God acts.⁵⁴ Berkeley's immaterial aether has much in common with Newton's quasi-material fluid, being 'subtle and elastic' and pervading 'throughout the whole universe'. Like Newton, Berkeley faces the problem of proof, but he is much less reliant on empirical methods. For Berkeley, experiment can only take the philosopher so far: 'We have no proof either from experiment or reason, of any other Agent, or efficient cause, than Mind, or Spirit.'⁵⁵ Berkeley's immaterial agents do not require experimental proof but rather faith.

Despite his echoes of Newton's work, Berkeley sets his work apart from material models of aethereal forces.⁵⁶ He denies that matter has innate powers of motion, and that there is a universal aethereal principle displayed in matter, because 'the laws of gravity, magnetism, and electricity are divers', and thus require the intervention of a divine presence who can vary the aspects of the active principle.⁵⁷ For Berkeley,

all those various motions and effects . . . seem inexplicable on mechanical principles; or otherwise than by recourse to a mind or spiritual agent . . . who connects, moves, and disposes all things, according to such rules, and for such purposes, as seem good to him.⁵⁸

Berkeley does not connect electrical phenomena with his aethereal spirit but instead claims that they have their own obscure cause, which is a mediation of divine power.⁵⁹ As in Newton's work, therefore, there is a conceptual gap in Berkeley's account relating to the causes of electrical phenomena. But Berkeley is content to preserve such obscurity. As Benjamin notes, his 'adherence to the view that natural philosophy cannot find causal explanations of natural phenomena was a result of his contention that man cannot rationally understand how God acts in the world'.⁶⁰ Systematic attempts to master this mystery are, for Berkeley, both ignorant and impious.

Berkeley also departs from Newton in his invocation of anima, or 'soul of the world'. He makes an unusual move in supporting his argument through appeals to the work of ancient philosophers, rather than that of modern empiricists:

The phaenomena of light, animal sprit, muscular motion, fermentation, [and] vegetation . . . seem to require nothing more than the intellectual and artificial fire of Heraclitus, Hippocrates, the Stoics . . . and other ancients . . . And this animated heterogeneous fire should seem a more adequate cause whereby to explain the phaenomena of nature, than one uniform aethereal medium.⁶¹

Berkeley distinguishes his ‘heterogeneous fire’ from the materialist connotations of empiricist accounts of aether. And despite its ancient, pagan, provenance, his ‘fire’ does not preclude the presence of a divine authority, even a Christian God. ‘If nature be supposed the life of the world, animated by one soul . . . this system cannot be accused of Atheism; though perhaps it may of mistake or impropriety.’⁶² Despite his hedging, the ancient precedents for Berkeley’s account enable him to connect his aether with the soul in *Siris*, thus supporting his claims for its immaterial nature.

Berkeley at times uses the language of the aether and the soul interchangeably, but he distinguishes between their operations, using Platonic ideas, both ancient and modern. He cites with approval the Platonist claim ‘that the intellect resided in the soul, and the soul in an aethereal vehicle’.⁶³ Whereas Newton suggests aether is the medium for physical forces, for Berkeley it is the medium through which the immaterial soul ‘moves and acts upon the gross organs’. Berkeley seems to refer to the work of Henry More, for whom, as James Chandler notes, the aethereal vehicle was in fact material, ‘a highly subtilized form of matter that registered perceptual vibration and effected locomotion’.⁶⁴ But Berkeley does not engage in the debate over the nature of this medium. Instead, as in *Alciphron*, he emphasises the importance of figurative language in such discussions, noting: ‘Some moderns have thought fit to deride all that is said of aethereal vehicles, as mere jargon or words without meaning. But they should have considered, that all speech concerning the soul is altogether, or for the most part, metaphorical.’⁶⁵ For Berkeley, figurative images provide a language for concepts which would otherwise remain inarticulable. *Siris* makes extensive use of figurative language, especially analogy, to account for the connection between material and spiritual entities.⁶⁶ But as in *Alciphron*, in *Siris* Berkeley allows ‘proper’ analogies to slip into more loosely metaphorical ones. He seems to intuit that such figurative connections are epistemologically useful when theorising invisible, intangible agents.

Berkeley is never so dogmatic as to assert a connection between his immaterial aethereal spirit and electricity, but it demonstrates many properties that are assigned by other experimenters to the electric fluid. It is diffused throughout the universe, acts as a medium of a higher authority, and as Berkeley notes, it

seems the source of all the operations in nature . . . Were it not for this the whole would be one great stupid inanimate mass . . . [It] is supposed to be

everywhere, and always present, imparting different degrees of life, heat, and motion to the various animals, vegetables, and other natural productions, as well as to the elements themselves.⁶⁷

Berkeley emphasises the vital properties of ‘fire’, which are fundamental to eighteenth-century theorisations of electricity. But just as important, for Berkeley, is the way in which fire supplies intelligence to the ‘great stupid inanimate mass’. Drawing on his ancient sources, Berkeley insists that the soul of the world is not merely a vital principle, but also a sentient one.⁶⁸ The soul of the world has intellectual properties; it is ‘an aethereal spirit . . . actuated by a Mind’.⁶⁹ Berkeley’s conception of the soul of the world as a universally diffused, communicative, vital force in the universe has important elements in common with a range of later accounts of electricity, including those of Walker. But his aether or anima is also an immaterial, divine power, the instrument of an omnipotent God. Berkeley’s work demonstrates the theological flexibility of the language of electrical aethers, and reminds us that, to a degree often overlooked by electrical experimenters themselves, such language is always essentially, and vitally, figurative.

3 AETHER AND ELECTRICAL DISCOURSE

During the 1740s electrical experimenters seized on Newton’s subtle aethereal fluid to explain electrical phenomena.⁷⁰ The discovery of the Leyden jar made electrical demonstrations more accessible and more dramatic, raising the profile of electrical practice, but also demanding some theoretical explanation for those wonders, and Newton’s aether was an apparently universal solution. Heilbron is damning about the intellectual effect of such reasoning, noting a ‘fall in standards’ in philosophical investigations.⁷¹ But though aethereal theories lacked mathematical rigour, they ensured that the relationship between material and immaterial, earthly and divine forces that we have seen in the work of Newton and Berkeley remained at the heart of electrical research. Electricians from the most celebrated members of the Royal Society to commercial demonstrators and showmen reached for Newton’s model of aether to underpin their practice, and their published writings demonstrate how Newton’s work was translated and appropriated in various ways to serve the particular rhetorical purposes of this array of electricians.

Comparisons between an aethereal elastic spirit and the electric fluid were not new in the 1740s. In 1722 Benjamin Worster declared: ‘It is evident from several experiments that in electrical attraction, the particles of light and aether are forcibly repelled or driven away.’⁷² Worster does not clarify how aether and light operate in electrical phenomena, but seems to follow Newton’s account of aether in the *Opticks*. Worster’s text is something of an anomaly, but in 1743, Bryan Robinson’s *Dissertation on the Aether of Sir Isaac Newton* claims a stronger connection between electricity and aether. Electricity is not the focus of Robinson’s work, but he explains electrical phenomena according to an aethereal model:

The vapour thrown off from bodies made electrical by friction . . . passes more easily into dense bodies than into rarer bodies. For the denser the aether in any body is . . . the more opposition it will give to the entrance of the electric vapour into that body.⁷³

Heilbron dismisses Robinson’s work as a ‘pseudo-mathematical account’, but notes its important influence: ‘Beginning in 1745, all significant British electricians postulated a special electrical matter identical with, or similar to, the springy, subtle, universal Newtonian aether.’⁷⁴ The two most influential English electrical researchers of the 1740s, William Watson and Benjamin Wilson, use models of aethereal spirits to explain the effects of electricity, and their accounts demonstrate the pragmatic and the conceptual gains to be made from an aethereal model, as well as the problems caused by the conceptual lacunae in Newton’s account.

Watson, Fellow of the Royal Society and its chief electrical experimenter, makes frequent use of aether to explain electricity in his *Sequel to the Experiments and Observations tending to illustrate the Nature and Properties of Electricity* (1746). At first Watson limits himself to experimental observations, noting: ‘What I here call the electrical aether, is that atmosphere which surrounds . . . electrics.’⁷⁵ But he moves from such observations to grander speculations, which echo Newton: ‘The electrical aether is much more subtle than common air, and passes to a certain depth through all known bodies. It passes most readily through metals, water, and all fluids except resinous ones; then animal bodies, dead or alive.’⁷⁶ Watson’s aether, like Newton’s, is extended through the universe, and is vitalising. But he does not consistently or dogmatically subscribe to an aethereal model of electricity; he also invokes a language of fire indebted to Boerhaave.⁷⁷ He explores the distinction between the

two, asking ‘Whether or no, that, which . . . we call electricity, electrical aether, electrical power, &c. is any other than elementary fire?’⁷⁸ Watson’s queries suggest his concerns about whether electricity is material or immaterial. Boerhaave’s fire has an ancient precedent similar to that invoked by Berkeley, and though he claims it is material, it shares some of the spiritualised properties of Berkeley’s aether or soul.⁷⁹ Watson seems to support this suggestion that electricity is immaterial:

Does not the . . . separation of fire from bodies by motion . . . cause us rather to incline to the opinions of . . . *Boerhaave*, who held fire to be an original, a distinct principle, formed by the creator himself; than to those of our illustrious countrymen *Bacon*, *Boyle* and *Newton*, who conceived it to be mechanically producible from other bodies?⁸⁰

For Watson, electricity cannot be produced mechanically, but is drawn from an obscure, perhaps divine cause. He moves so often between references to ‘electrical fire’ and ‘electrical aether’ that the distinction between them is unclear. But though his thinking can appear muddled, Watson also perhaps uses the loosely defined qualities of aether to his advantage. His suggestion that electricity is produced by an immaterial aether allows him to assert the active presence of God in such phenomena.

Watson’s Royal Society contemporary Benjamin Wilson employed an aethereal model of electricity in a much more systematic fashion. His *Essay towards an explication of the phenomena of electricity, deduced from the aether of Sir Isaac Newton* (1746), extends Robinson’s analysis of Newtonian aether by investigating its connection with electricity.⁸¹ Wilson declares that ‘the *aether* and electric matter are the same’, and stresses that both have material causes.⁸² His text is primarily an account of his experimental findings, but he explains electrical phenomena throughout as an effect of the ‘vibrating motion of the aether’.⁸³ In his concluding ‘General Scholium’, Wilson applies Newton’s account of aether to electrical phenomena, declaring: ‘This electric or subtile matter, which . . . causes such various and surprising phaenomena, seems to be the great *Desideratum* to account for many of the wonderful operations in nature.’⁸⁴ Unlike Berkeley, and even Newton, who caution against assigning one cause for a range of phenomena, Wilson aligns electricity with the aether and makes it a universal cause. In similarly grand fashion he cites Newton’s caution about the lack of experimental proof for aether, but then asserts that the aether is an ‘*electric* and *elastic* spirit’.⁸⁵ Wilson assumes the

aethereal model of electricity to be sanctioned by Newton, and he uses that authority to shore up his claims.⁸⁶ But though he works from the same textual source as Watson, he draws an opposite conclusion about the nature of the aether; for Watson it is an immaterial spirit, whereas for Wilson it is a ‘vibrating’ material substance.

Despite this contrast with Watson’s work, Wilson struggles in a similar fashion to map his speculations about the aether on to his experimental work. Wilson’s *Essay* and his *Treatise on Electricity* (1752) rely heavily on the textual authority of Newton. Wilson acknowledges that his experimental findings do not always match his textual sources, and in an awkward move, asks his reader to apply an aethereal model even to his published experiments which make no mention of it: ‘If the electric matter is admitted to be the *aether*, my former papers will require very little alteration (if any) to render them equally agreeable to these my present sentiments.’⁸⁷ Such strained assertions signal that Wilson does not find a way to mediate between his textual sources and experimental methods. He attempts to make a virtue of his tendency to generalise from the findings of Newton, noting that an aethereal hypothesis is conceptually tidy: ‘it is the most universal and consistent with itself . . . in the most plain and simple manner it accounts for the other phaenomena in nature, as well as those of electricity’.⁸⁸ Wilson’s collaborator Benjamin Hoadly also stresses the benefits of reducing the number of causes for electrical phenomena in their co-authored *Observations on a series of electrical experiments* (1756), declaring of electricity and aether that they are ‘one and the same fluid; as it is much more philosophical . . . than to suppose two such fluids . . . which would be multiplying causes, where there is no manner of occasion’.⁸⁹ But Hoadly’s claims differ from Wilson’s on a crucial point of theology, again demonstrating the interpretive openness of Newton’s theological claims. In contrast to Wilson for whom electrical aether is always material, Hoadly’s support for a singular cause echoes both Berkeley’s and Newton’s evocation of a divine first cause of natural phenomena. Though he suggests that aether itself is material, Hoadly makes it a medium through which God acts on the world: ‘This *aether*, from its being so general a material cause, may probably be the great instrument, by which the Almighty directs, governs, and supports the universe.’⁹⁰ For Wilson and Hoadly, electric aether can be both a ‘material cause’ of natural phenomena, and an instrument of divine authority. The collaborators differ on the role of God in this process, but they are united in their struggle to articulate how the material and spiritual interact in this model. Thus

while Newton's aether enabled Royal Society Fellows to claim the continuation of his legacy in the institution, and in upholding the presence of God in nature, they struggled to translate Newton's suggestions into a coherent philosophical model of electrical phenomena.

Newton was not merely an inspiration to philosophers working within the Royal Society. Larry Stewart has shown how Newtonian ideas informed the practice of a huge range of 'public science' at this period, including that of much less respectable practitioners of experimentation and display.⁹¹ Models of Newtonian aethers inform the practice of a range of electrical laymen, and as these experimenters are often less interested than Watson or Wilson in producing a consistent theory from their experimental findings, they range freely over the figurative connections and occult causes suggested by the model of the aether. Both Benjamin Rackstrow, an electrical showman and instrument maker, and Richard Lovett, a lay preacher and electrical healer, appeal to Newton's authority in their use of aethereal models of electricity, but neither is interested in the consistent application of any one hypothetical cause of electrical phenomena, and their works appropriate a range of ancient and modern sources. The demonstrator Benjamin Martin, whose work I discussed in [Chapter 1](#), is interested in aethereal models of electricity, but he warns of the dangers of straying too far into speculation over the nature of such obscure causes.

Rackstrow's *Miscellaneous observations, together with a collection of experiments on electricity* (1748) outlines a series of electrical demonstrations, and explains their causes using a model of electrical aether. In a circuit, 'the particles of Aether . . . bring along with them in their progression all light bodies; but when those light bodies touch the body electrified, they become saturated and repell'd with force, by the fresh influx of Aether.'⁹² Like his contemporaries too, Rackstrow moves from empirical demonstration to speculations about the operation of the aether in the universe: 'This pure Aether, fire, or light, the mighty Agent in the hands of our Great Creator, expands itself through the heavens, is always restless, and instantaneous in its motion . . . passes through and pervades the pores of all bodies.'⁹³ Here aether is an agent of God, but Rackstrow does not examine the operation of any divine power. He acknowledges his debt to Newton, but also uses a wider range of sources.⁹⁴ As Rackstrow's reference to aether's 'restless' qualities suggests, an important source for his analysis is Berkeley's *Siris*, though he also draws on ancient accounts of 'elementary fire'.⁹⁵ Like Berkeley, Rackstrow is attentive to the figurative qualities of his

declarations about the aether. He declares that ‘the expressions Electricity, Electrical Fire, and Aethereal Fire are synonymous’, and that all have vital powers.⁹⁶ But in contrast to Wilson, even when indulging speculation about vitality, and using the language of aether and fire in a loose, suggestive fashion, Rackstrow ties his conclusions back to his experimental observations. Though he undoubtedly trades off the authority of Newton’s models of aether, and enjoys the speculation that such models prompt, Rackstrow refuses to move away from the evidence of his senses, a quality that he shares with Martin.

Richard Lovett was not an electrical performer, but like Rackstrow, he is removed from the philosophical institutions which might give weight to his arguments, and turns to Newton’s work as an alternative form of authority. Lovett makes surprisingly few claims for the divine qualities of the electrical fluid, claiming it instead as indirect evidence of God’s benevolence through its function as a universal panacea, a suggestion which is taken up by John Wesley in his medical text *The Desideratum; or, Electricity Made Plain and Useful* (1759).⁹⁷ Neither Lovett nor Wesley is an empiricist. Lovett’s *The subtil medium prov’d* (1756) is a series of case histories demonstrating the efficacy of electrical healing, but he prefaces those cases with a survey of accounts of this ‘subtil medium’. Like Rackstrow, Lovett notes, ‘I have made use of the terms *fire, electricity, electrical fire, electrical aether, aethereal spirit, &c.* as synonymous’, though he does not comment on the nature of these connections.⁹⁸ Lovett claims that ‘I was perhaps the first, that ever maintained that the electrical Fluid and the Newtonian Aether were one and the same’, but undermines his primacy by drawing on a range of sources that make similar claims.⁹⁹ Lovett argues that ‘the aether of the modern philosophers [is]...the elementary fire of the ancients’, but does not distinguish between fire and aether in ancient or modern philosophy.¹⁰⁰ Instead he explains Newton’s aether using a series of models of the ‘subtil medium’ which contradict Newton, including that of Berkeley.¹⁰¹ Perhaps unsurprisingly, Lovett’s approach was poorly received by the *Monthly Review*, which declared him both too dependent on and too ignorant of Newtonian principles.¹⁰² The *Monthly* critiques Lovett’s dogmatic use of Newton’s work, and his privileging of textual over experimental practice. It notes that Newton was only beginning to establish ‘the temple of true *physical science*’, and reminds Lovett of Newton’s plea for caution until hypotheses are experimentally proven.¹⁰³ The *Monthly* suggests that though Newton’s *Opticks* presents experimenters and philosophers with

a productively open and suggestive model through which to explore electrical phenomena, there are limits past which hypotheses over the nature of the aether transgress into speculation.

Martin, as we have seen, was another experimenter and demonstrator operating outside of the support and also the constraints of the Royal Society. Martin like his contemporaries cites Newton's *Opticks* as a key source for his *Essay on Electricity* (1746). But he warns against assuming a connection between Newton's aether and the electric fluid. In his *Philosophia Britannica* (1759), Martin echoes the *Monthly Review* in criticising electricians who assume Newton's queries to be fact, and apply them to electrical phenomena. For Martin, as the 'material cause' of the elasticity of aether is unknown, it cannot be 'admitted... as a principle of the *Newtonian* philosophy'.¹⁰⁴ He declares, 'we want nothing but the *Proof of such an Aether* to account for almost every thing by it. But is it not a preposterous Proceeding to account for any Thing by a Principle in itself unaccountable, and utterly unknown?'¹⁰⁵ Martin objects to the movement between the terms 'power, spirit or aether', suggesting that each has its distinct meaning. He advocates a return to Newtonian experimental methods which acknowledge the limits of the evidence of the senses, declaring that experimenters must search for the 'agent' of attraction and repulsion in electricity and other phenomena, which is the '*Desideratum*' in philosophy.¹⁰⁶ Martin suggests that it is discoverable through experiment and is thus material, but he steers clear of any definitive claim.

Martin offers perhaps the clearest account of the dangers of reliance on aethereal models of electricity. He notes, 'we can now almost prove the existence of this *Aether* by the Phaenomena of Electricity', but suggests that this is actually disproved by experiment.

We find it very easy to prove that Electricity is nothing but this very Aether... But... when we enquire into the Nature and Properties of this Aether and Electricity, we shall find them so very different and dissimilar, that we cannot easily conceive how they should thus mutually prove each other.¹⁰⁷

Martin offers series of experimental proofs of this claim, concluding 'I see no cause to believe that the Matter of Electricity is any thing like the Idea we ought to have of the *Spiritus Subtilissimus* of Sir Isaac.'¹⁰⁸ He thus offers a robust critique of the use of Newtonian aether as a model for

electricity. So thorough are his claims that though he ends by praising Newton's systems for the way they inspire reverence for God, Martin seems to leave no room for the possibility that electricity is immaterial, or for the suggestion that active powers resist experimental proof and thus demand faith.

The argument about the material or spiritual origins of electrical phenomena is one key to understanding the enmity between Martin and John Freke discussed in [Chapter 1](#). As Schaffer notes, 'Freke's work contrasted with Martin's at every point. Electric fire was not due to active powers placed in matter by God . . . Instead, electric fire was an emanation of the *Anima Mundi* and so comprehensible through knowledge of the soul alone.'¹⁰⁹ Freke has no interest in experimental work, preferring like Lovett to proceed from textual sources. Though he does not name *Siris*, Freke seems indebted to Berkeley's account of fire, in particular his sharp distinction between material and immaterial powers. Freke claims that 'Matter [is] the Body, and Fire the Soul, of the World', and that electrical phenomena are evidence of spiritual fire.¹¹⁰ He does not dwell on the nature of this fire, but attacks Martin by ridiculing aethereal models of electricity (overlooking the fact that Martin does so too), declaring 'I never was indeed the dupe of that philosophical gibberish of *nervous fluid, aether*, &c. which, proving nothing to the senses, established nothing.'¹¹¹ Despite Freke's polemical appeal to the 'senses', however, he makes electricity an immaterial 'soul of the world'; even aether is too material to interact with this electric spirit. Freke's work thus demonstrates the survival of spiritual models of electricity into the second half of the eighteenth century.

The range of appropriations of Newton's aether, and their various applications to electrical phenomena prove both the malleability of the discourse of aether, and the pervasive uncertainty about the provenance of electricity. Natural philosophers and experimenters advanced an aethereal model of electricity for a range of reasons. Such claims helped electricians brand their practice as Newtonian, which enabled claims for the immaterial, even divine provenance of electricity, and offered a universally applicable model for a range of electrical effects. But for strict empiricists like Martin, such models simply did not stand up to experimental testing. When aethers were deployed as if they were fact and not figures, they offered little insight into how electricity might actually function. The dogmatism of many electrical researchers at this period, and their eagerness to apply Newton's suggestions in the *Opticks* to electrical phenomena,

can be considered bad science. But such practices raise important theological questions too. They reveal connections between the experimental practices of those of opposing religious stance, and demonstrate unanswered questions relating to the influence of and the medium for God's active presence in the world. The question of electricity's material or immaterial status also shadows the more explicitly experimental concerns of celebrated practitioners of electrical science like Benjamin Franklin and Joseph Priestley.

4 BENJAMIN FRANKLIN AND EBENEZER KINNERSLEY

Electrical experimenters attempted to move away in the second half of the century from obscure quasi-spiritual models of aether to an account of matter imbued with its own life and motion, a process with important theological and political implications. But this by no means produced a straightforward, secularising effect, and the influence of aethereal models persisted. In the final sections of this chapter I examine how models of electrical aethers survived in accounts of electricity in England and America. I begin with the work of Benjamin Franklin and Ebenezer Kinnersley in the American colonies in the 1740s and 1750s.

In his response to his slating in the *Monthly Review* in 1766, Lovett notes that his claims for electrical aether result from his reading of two key texts. The first is Berkeley's *Siris*, but the second is 'the ingenious Dr Franklin's Letters . . . which more and more confirmed me in my opinion'.¹¹² For Lovett, Franklin proved through experimental practice what Berkeley had suggested in theory; together, their work constitutes proof of an electric aether. His pairing of Berkeley and Franklin is an audacious move, as the work of the two differs both methodologically and theologically. Franklin's experiments in electricity proceed from close observation, and avoid any speculation about obscure, potentially divine causes. He employs a resolutely secular language throughout his work on electricity, does not publish any declaration of religious faith, and never employs aethereal language to account for electrical effects. But historians of science, like Lovett, have tended to connect Franklin's electrical experimentation with aethereal fluids, claiming that his account of electricity arises out of Newtonian models of aether.¹¹³ The relation of Franklin's work to aethereal discourses of electricity and their associated theological implications is a complex one. In contrast to English experimenters of the 1740s, Franklin attempts to rid electrical discourse of the mystical

overtones of immaterial principles, and attempts to materialise and secularise electrical practice, but this is not a straightforward process, as the work of his collaborator Kinnersley demonstrates.¹¹⁴

Franklin was the leading practitioner of electrical science in the American colonies, becoming the first to identify electricity with lightning, and his engagement with discourses of aether was shaped by this colonial context. Franklin is likely to have read Newton's *Opticks* but not the Latin *Principia* and neither did he read the more dogmatic English assertions of the connections between aether and electricity.¹¹⁵ Franklin knew the *Opticks's* account of aether, but seems to have focused on Newton's assertion that all speculation must be supported by experiment and observation.¹¹⁶ As Franklin read more English electrical research in the 1750s, he became aware of the disputes over the aether. But in contrast to his contemporaries he assigns little authority to textual sources. As Cohen notes,

as to the elastic fluid itself, he could not learn from books if it was merely the Newtonian aether . . . or a kind of matter *sui generis*. Only experiments and the exercise of the imagination could tell him the specific properties and laws of action with which an 'electric fluid' needed to be endowed in order to account for the phenomena described by Watson, Wilson and Martin.¹¹⁷

However, Franklin's insistence on experimental rigour does not, like Newton's, derive from a need to investigate the operation of a divine power upon the world. His focus on experiment suggests a rejection of speculations about electricity's divine provenance, which echoes Franklin's discussion of religion elsewhere. He famously expresses impatience with organised religion in his *Autobiography*, and he makes no public professions of faith in his electrical works.¹¹⁸ Frank Kelleter describes Franklin's Christian beliefs as 'a self-evident faith', prompted by a thorough examination of the material world.¹¹⁹ This pragmatism shapes the way in which he engages with the electrical work of Newton and his followers.

The title of Franklin's *Experiments and Observations on Electricity* (1751), a collection of letters to Royal Society correspondents between 1747 and 1750, signals a debt to Newton's empiricism, and the Preface by Franklin's colleague John Fothergill emphasises these Newtonian qualities. Fothergill makes Franklin's electric fluid sound much like Newton's aether. It is 'an invisible, subtle matter, disseminated through

all nature in various proportions, equally unobserved... [But] if an unequal distribution is by any means brought about... it becomes perhaps the most formidable and irresistible agent in the universe.'¹²⁰ Despite Fothergill's gestures to Newton, Franklin avoids discussions of aether in his electrical writings. In an April 1749 letter to a Royal Society correspondent, clearly writing in speculative mode, Franklin remarks on the relationship between 'common fire' and 'electrical fire', noting 'perhaps they may be different modifications of the same element; or they may be different elements'.¹²¹ For Cohen 'Franklin shows the influence of ideas put forth by Newton in Queries 18–24 of the *Opticks*.'¹²² But Franklin does not use the language of aether in this letter, and he lists a series of electrical experiments designed to distinguish between aether and electricity. For Franklin 'electrical fire' is not a theory derived from ancient philosophy, but a phenomenon to be experimentally tested.

In his 1749 letter 'Opinions and Conjectures concerning the Properties and Effects of the Electrical Matter', Franklin does not name the 'subtle fluid' under discussion, except to call it 'matter'. He asserts that 'electrical matter consists of particles extremely subtle, since it can permeate common matter... with such ease and freedom as not to receive any perceptible resistance'.¹²³ Rather than explain the subtlety of 'electrical matter' according to an immaterial property, Franklin uses a homely image, declaring that 'common matter is a kind of sponge to the electrical fluid'.¹²⁴ Franklin makes use of other similes of this type in this letter, for instance comparing the effectiveness of a pointed conductor to the ease of 'plucking the hairs from the horse's tail' one by one.¹²⁵ As Delbourgo notes, this method is an important aspect of Franklin's self-presentation as a humble, autodidact experimenter, but it also signals his peculiar self-consciousness about his use of figurative language to communicate new ideas.¹²⁶ Franklin's 'sponge' and horsehair similes are arresting in their homeliness, and are a defamiliarising move, drawing attention to the need for new terms which even then can only gesture towards an explanation for electrical phenomena. As Franklin states later in this letter, 'I feel a want of terms here, and doubt whether I shall be able to make this part intelligible.'¹²⁷ Rather than look to ancient precedent or divine sanction, he treats electrical effects as material phenomena for which a quotidian language must be found.

But despite his distrust of the language of aethers, many of Franklin's pronouncements on electricity do seem to derive from Newton's *Opticks*. Franklin notes in a 1753 letter to Peter Collinson that 'this globe of earth and water, with its plants, animals, and buildings, have diffus'd throughout

their substance, a quantity of the electric fluid'.¹²⁸ Electricity is not only universally diffused, but like the aether also subtle and elastic. In 1752, replying to a correspondent in New York, Franklin notes: 'Your conception of the electric fluid, that it is incomparably more subtle than air, is undoubtedly just', and suggesting that 'universal space, [is] filled with [this] subtile elastic fluid'.¹²⁹ In a rare moment, Franklin even acknowledges the spiritual implications of electricity.

There may be, as the Antients thought, a region of this fire above our atmosphere . . . yet some of it be low enough to attach itself to our highest clouds, and they then becoming electrified, may . . . descend towards the earth, and discharge their watry contents, together with that aetherial fire. Perhaps the Aurorae Boreales are currents of this fluid in its own region, above our atmosphere . . . There is no end to conjectures.¹³⁰

Franklin not only refers to the aether here, but also connects Newton's account with more recent investigations of lightning and the aurora borealis. But he poses these suggestions as queries or 'conjectures', and focuses on measurable effects rather than obscure causes.¹³¹ And the same letter suggests that for Franklin these causes are material not spiritual. He even points out the heterodox nature of his remarks:

It is well we are not, as poor *Galileo* was, subject to the Inquisition for *Philosophical Heresy*. My whispers against the orthodox doctrine, in private letters, would be dangerous; but your printing and printing would be highly criminal. As it is, you must expect some censure, but one Heretic will surely excuse another.¹³²

Franklin's tone is playful, and it is not easy to discern whether he sees his 'heresy' in purely philosophical terms, or also in religious ones, but it seems this is an admission of religious heterodoxy, of a materialism that might amount in the minds of an 'inquisition' to atheism.

Though Franklin makes few public claims for the material nature of electricity, the logic of his account of the electric fluid, in which electrical charge is never lost, only moved from one position to another, and thus conserved, seems to leave no room for the active intervention of God, as Cohen has discussed.¹³³ This model of a self-regulating system strengthens the implications of Franklin's avoidance of the language of aether, suggesting a secular basis to his account of electricity. And the response of Franklin's

contemporaries suggests that his joking concerns about charges of heresy were just. An anonymous pamphlet *A Letter to Benjamin Franklin* (1777), which attacks Franklin's work on electricity, brings together his methods and expression, and their theological implications, as targets for attack. Franklin does not merit the title of philosopher, the writer argues, because he is 'illiterate', working from experiments rather than textual precedents. This in turn suggests impiety because it appropriates to the experimenter the authority of God. The author develops the attack by suggesting that such heterodoxy is confirmed by Franklin's 'vulgar' use of language, his employment of quotidian terms to account for the operations of electricity, which draw attention to the occasionally figurative nature of his account.¹³⁴ The *Letter* is a pointed polemic against all aspects of Franklin's practice, but it raises an important point about the absence of spiritualised language in his experimental works. Though he is indebted to the empirical basis of the *Opticks*, Franklin removes Newton's suggestion of a spiritualised universe and makes electricity a purely material phenomenon.

Franklin's work contrasts in important ways with that of his collaborator, Ebenezer Kinnersley. While they agreed on the experimental effects of electrical phenomena, they interpreted their causes very differently. The contrast lies primarily in their sense of electricity's religious significance. While for Franklin electricity was material, as Nina Reid-Maroney has shown, Kinnersley's natural philosophy 'moved with ease through the invisible world of Newtonian forces and active powers'.¹³⁵ Kinnersley shows that it is possible to adhere to Franklin's account of electricity while professing faith and that the key to doing so is the careful manipulation of electrical language. As Reid-Maroney notes, while Kinnersley agreed that electricity was a 'type of matter, he recognised that the term was . . . an analogy that helped to explain what was going to happen next'. She emphasises Kinnersley's 'willingness to think of scientific language in this hypothetical way' as key to his profession of faith.¹³⁶ Kinnersley's emphasis on the figurative nature of electrical discourse echoes Berkeley's insistence in *Siris* that the language we use in such discussions must always be in a sense 'metaphorical'. Kinnersley's intuition of the provisional nature of electrical discourse allows him to move beyond the distinction between material and immaterial that obsesses many researchers.

Kinnersley's appreciation of the figurative nature and the performative aspects of language perhaps arises from his two distinct careers. Kinnersley, like Franklin, was a writer, but while Franklin was concerned with the

production of print in his work as the editor of the *Pennsylvania Gazette* newspaper, Kinnersley focused on oral performance and rhetorical display, first as a Baptist minister and later as an electrical demonstrator.¹³⁷ J. A. Leo Lemay dismisses the first part of Kinnersley's career in order to focus on the 'enlightened' aspects of the second, but Kinnersley sustained his Baptist faith, and this faith seems to have informed his conception of electricity.¹³⁸ In contrast to Franklin, as Reid-Maroney notes, Kinnersley upholds Newton's 'active powers' and 'the theological position from which Newton himself explored them'.¹³⁹ And Kinnersley asserts the active intervention of God even more clearly than Newton. His focus on 'active powers' enables him to claim that electricity is the work of God but also that its effects can 'be measured and predicted'.¹⁴⁰ Kinnersley presents his experimental practice as having divine sanction, and is thus untroubled by the obscure causes of electrical phenomena.¹⁴¹

Kinnersley does not use the term aether to explain electricity but the newspaper advertisements for his lectures name an 'electric fire', which is as 'a real element', and 'an extremely subtile fluid', 'intimately mixed with . . . all the other fluids and solids of our globe'.¹⁴² Despite his interest in 'active powers', then, Kinnersley suggests in his experimental practice that electricity is material. His *Course of Experiments on the Newly Discovered Electrical Fire* (1752) uses a range of different modes and rhetorical tools. Kinnersley presents himself as a rational empiricist, but he also flirts with a language of revelation.¹⁴³ He demonstrates alcoholic spirits set alight by an electric spark from a finger, and declares:

Hence it is sufficiently evident, that real, visible, burning fire is part of the composition of these bodies of clay!

Indeed we are fearfully and wonderfully made!

For every person living contains enough of the fire to burn a house . . .

A few years since, this . . . might have passed for a miracle and an impostor might have us'd it among the ignorant to establish a false doctrine & overthrow a true one.¹⁴⁴

Kinnersley uses a scriptural register to suggest that physiology is mysterious beyond human understanding, and describes the vital properties of electricity as a 'flame' which like God's 'breath of life' in Genesis animates lifeless clay.¹⁴⁵ But in the next breath he praises experimental research for thwarting exploitation of 'the ignorant' and casting doubt on miraculous wonders. In criticising 'impostor[s]', Kinnersley gestures to the work of electrical showmen like

Rackstrow or Martin, but rather than attempt to suppress these illegitimate associations, Kinnersley echoes such practices in his oratory and display, suggesting that the more spectacular elements of electrical experimentation are inherently connected with empirical practice and with divine order.

Kinnersley's demonstrations are certainly spectacular; he describes experiments featuring 'Mahomet's tomb' which floats on air, as well as electric spiders and a fish 'made out of [gold] leaf, whose head is not so sharp as his tail. . . . Let him swim in the air near the electrified [prime conductor]. He will throw the fire off from his tail to bodies at a great distance.'¹⁴⁶ He also encourages audience participation, which can have a bathetic effect, as his claims veer from sublime to quotidian. Kinnersley considers whether the planets are kept on their course by electrical repulsion, concluding:

By whatsoever natural causes these glorious suspended worlds are kept asunder . . . that cause is in the hands of the great Maker and Governour of the Universe. Shou'd he then for the punishment of our sins decree in his anger to withdraw it, which Mercy forbid! All the planets and their satellites . . . wou'd rush suddenly together, dash each other to pieces, and form one mighty ruin.¹⁴⁷

Though Kinnersley does not use the language of the aether in this passage, it suggests his belief in active principles as agents of God whose powers can be controlled or even withheld according to divine will.¹⁴⁸ But Kinnersley's theological position is complicated by the lines that immediately follow:

Electricity . . . [is] capable also of affording some entertainment to the ear. For a phial electrified will for a long time continue to ring a number of small bells.

At the conclusion of this part, the company were saluted with a discharge of cannon from an electrical battery by a spark proceeding from a person's finger.¹⁴⁹

Even when wrestling with questions of faith and of active forces in the universe, Kinnersley has one eye on his audience. Throughout his lecturing and published work, he upholds three elements of a disclaimer which appears in each of his newspaper advertisements:

As the knowledge of nature tends to enlarge the human mind, and give us more noble, more grand and exalted ideas of the AUTHOR of NATURE;

it is presumed that this course of experiments will meet with encouragement as a rational and commendable entertainment.

‘The works of the LORD are great, and sought out of all them that have pleasure therein.’ Psalm CXI, 2.

Kinnersley appeals to reason, and to the power of ‘the AUTHOR of NATURE’, but he also celebrates ‘entertainment’ and ‘pleasure’. He does not emphasise the mystery of electrical phenomena here, suggesting instead that the lectures will provide a comprehensive ‘knowledge of nature’. But the lectures themselves sustain the importance of ‘wonder’, which, for Kinnersley, is a fundamental aspect of a philosopher’s engagement with the world, because it demands a recourse to faith.

Kinnersley’s balance of different rhetorical elements and alertness to the indeterminate status of electricity reflect his skills in oratory. An attendee at his lectures writes that ‘he performs them extremely well, being a master of words as well as of the experiments’.¹⁵⁰ As we saw in [Chapter 1](#), in his advertising materials Kinnersley promises ‘Spirits kindled by fire darting from a lady’s eyes (without a metaphor)’.¹⁵¹ He plays here on the power of the female gaze to entrap, but by insisting that this is actual rather than metaphorical ‘fire’, he emphasises electricity’s indeterminate status, which is somewhere between a material and immaterial substance, producing effects that are somewhere between the literal and metaphoric. Like Franklin, Kinnersley resorts to figurative language in order to describe electrical effects, but he demonstrates an unusual self-consciousness about his use of such terms. In his *Course of Experiments*, Kinnersley comments on the term ‘electric fluid’, noting ‘we call it a fluid, because, when a quantity of it [is] thrown on a non-electric body it instantly spreads itself over every part’.¹⁵² Kinnersley’s attention to the metaphorical qualities of his own language, and the way in which electricity demands and refuses figurative explanations, connects his work in important ways to contemporary discussion of religious feeling in the American colonies during the Great Awakening of the 1740s and 1750s.

The Great Awakening produced a surge in evangelical preaching and conversion, catalysed by itinerant preachers like George Whitefield.¹⁵³ This evangelical fervour was attacked in newspapers for its disruptive social effects, and in 1740 Kinnersley himself decried the ‘horrid harangues’ of evangelical preachers in Philadelphia.¹⁵⁴ The most sustained critique of evangelical itinerancy in these terms came in an essay in the *General Magazine and*

Historical Chronicle of February 1741, published by Franklin, entitled ‘A True and Genuine account of a wonderful WANDERING SPIRIT’. In the essay, this ‘spirit’ has travelled from its origin in Europe and has recently ‘been seen, felt and heard by thousands in *America*’. Its effects are dramatic: it ‘deals much by feelings and impulses, in violent bodily convulsions; and pretends to uncommon discernments. When it possesses the mob . . . they swell and shake like . . . those possessed with the devil in the gospel.’¹⁵⁵ But unfortunately for those who would control it, the spirit is impossible to contain. ‘Like *Proteus*, it assumes most shapes . . . It acts the busy-body, is here and there, and everywhere, and above all things, hates rules and good order, or bounds and limits.’¹⁵⁶ The only means to identify the spirit is to observe its symptoms: ‘Say-soes and declarations, wry-faces and grimaces, contortions of the body and vocal energy’.¹⁵⁷ And the only antidote to its effects is to bypass its influence and to turn to the authority of Scripture: ‘Its malice and cruelty toward all that will not renounce scripture and reason, discovers to all . . . that it has a cloven foot.’¹⁵⁸ This essay shares important elements with other denunciations of enthusiasm in England and in America, but its use of the term ‘wandering spirit’ to describe the progress of evangelism is striking for its figurative connections with the contemporary discussions of electricity.

Despite Kinnersley’s condemnation of evangelical preaching, the essay’s ‘wandering spirit’ has several characteristics in common with his accounts of electricity. Indeed, the essay offers a clue as to how his own itinerant career may have informed his conceptualisation of electricity. In both the essay and in Kinnersley’s lectures, it is unclear whether this ‘spirit’ is a material or immaterial force. Like electricity it seems to spread free of physical control, but it produces ‘grimaces [and] contortions of the body’, and operates as a medium of communication, passing from person to person beyond ‘bounds and limits’. And this ‘wandering spirit’ advocates direct evidence of the presence of God, bypassing scriptural authority. Kinnersley’s practices, like Franklin’s and Martin’s, might be read in similar terms; he insists on the primacy of experimental evidence over textual precedents, and declares that the audiences for his lectures must be present in person to understand the effects of his experiments. Kinnersley’s account of his second lecture promises ‘a Diverting experiment, which cannot well be comprehended but by those who try it’; demanding that his audience see it for themselves rather than rely on the mediation of others.¹⁵⁹ Kinnersley’s electrical practice demonstrates that

even empirically grounded electrical experimentation can have elements in common with a faith that favours enthusiasm over reason.

The American careers of Franklin and Kinnersley thus reveal an important variation on the debate over the divine origin of electricity. Though they both reject the language of quasi-immaterial aethers and offer an at times almost chauvinistic confidence in empirical practice, they are both alert to the figurative status of electricity. They do not appeal to strict, proportionate use of analogy but rather make frequent and explicit use of metaphor and other figurative connections to account for the effects of electricity. But as a result of this insistence on electricity's indeterminate status, Kinnersley's work in particular is liable to shift figurative registers itself, and to demonstrate its connections with much less reputable forms of religious and experimental practice. And in the 1770s and 1780s, as I discuss in [Chapter 4](#), the 'restless' communicative properties of Franklin's and Kinnersley's electric fluid takes on explicit political significance. Franklin's identification of lightning as electricity and development of the lightning rod is united in the public mind in America and France with his leadership of American resistance against British colonial rule, and he is reimagined at the end of the century as a Promethean figure whose revolutionary influence is communicated from man to man like the electric principle.¹⁶⁰ Such appropriations have their root in Franklin's early electrical work. For Franklin, electricity is not the agent of a divine power but a quotidian force available to all.

5 JOSEPH PRIESTLEY AND ADAM WALKER

Joseph Priestley and Adam Walker were British researchers with important links to Franklin; as Golinski notes, Priestley was a member of 'the philosophical and political club dubbed by Benjamin Franklin "the Club of Honest Whigs", which met in St Paul's Coffee House' in London in the mid-1760s, and the two sustained both their friendship and their philosophical collaborations.¹⁶¹ But unlike Franklin, Priestley unites his religious faith with his empirical electrical research; indeed as J. G. McEvoy and J. E. McGuire note, 'key to [all] Priestley's thought lies in his conception of theology', though his faith is of a very different order to that of researchers like Kinnersley or Newton, and his account of the action of God in electrical forces is also distinct.¹⁶² Priestley is the first historian of electrical science. His *History and Present State of Electricity*, first published in 1767, presents electricity as a science of

progress; Priestley traces its history but also promotes future research and collaboration, an aspect emphasised by his reviewer in the *Monthly Review* who notes that ‘*insulated* electricians in the country . . . will be able to rejoice in receiving *sparks* of intellectual intelligence from so excellent a *prime conductor*’.¹⁶³ But despite Priestley’s confidence in future progress he celebrates the limitless effects and obscure causes of electrical phenomena: ‘The electric fluid is no local, or occasional agent in the theatre of the world. Late discoveries show that its presence and effects are every where, and that it acts a principal part in the grandest and most interesting scenes of nature’, in the minutiae of chemical reactions as well as atmospheric and celestial spectacles.¹⁶⁴ Priestley, like Franklin and Kinnersley, advocates experimental work over scholastic precedents, but makes this work evidence of God’s presence:

The instruction we are able to get from books is, comparatively, soon exhausted; but philosophical instruments are an endless fund of knowledge. By philosophical instruments . . . [I mean] the air pump, condensing engine, pyrometer, &c. (with which electrical machines are to be ranked) . . . which exhibit the operations of nature, that is of the God of nature himself, which are infinitely various.¹⁶⁵

Philosophical investigation, for Priestley, thus inculcates ‘benevolent and pious sentiments upon the mind’.¹⁶⁶ But despite these claims that natural phenomena are evidence of the presence and the benevolence of God ‘the first cause of all’, Priestley has little time for theories of active powers and imponderable fluids.¹⁶⁷ As McEvoy and McGuire note, Priestley does not uphold a ‘voluntarist’ account of nature which claims ‘God’s dominion as a sovereign action over all creation’.¹⁶⁸ His view of the role of God is thus distinct from predecessors like Newton, as he refuses a sharp distinction between divine creator and creation.

In the *History* Priestley does not criticise Newton’s account of aether, but neither does he uphold that model.¹⁶⁹ Instead he stresses electricity’s obscurity, noting:

the phenomena of electricity are so odd, that, though we have a great many experiments upon that subject, we have not yet been able . . . to settle such a theory as will lead us to the cause of that property in bodies, or even to judge of all its effects, or find out what useful influence electricity has in nature.¹⁷⁰

Priestley does not use an aethereal model to explain such phenomena, merely noting that Newton ‘imagined electric bodies when excited emitted an elastic fluid, which freely penetrated glass’.¹⁷¹ In the first section of the *History*, Priestley, like Franklin, uses the terms ‘electrical fire’ and ‘electric matter’ but not ‘aether’.¹⁷² In a survey of electrical theories, he notes the opinion of experimenters like Wilson that ‘the chief agent in all electrical operations is Sir Isaac Newton’s ether’, but he does not advocate this view himself, noting merely that a ‘greater number of philosophers suppose . . . that there is a fluid *sui generis* principally concerned in the business of electricity’.¹⁷³ Eventually Priestley states his opinion, noting the ways in which electricity ‘so much resemble[s] the ether of Sir Isaac Newton in some respects, and yet differ[s] from it so essentially in others’:

The electric fluid is supposed to be, like ether, extremely subtile and elastic . . . but, instead of being . . . repelled by all other matter, it is strongly attracted by it . . . But no other property can account for the extraordinary quantity of this fluid contained within the substance of electrics *per se*, or the common atmospheres of all excited and electrified bodies.¹⁷⁴

Priestley uses experiment and observation to distinguish between theories of aether and electricity, though even here he admits an obscurity; experimenters are unable to explain the ‘quantity’ of the electric fluid in certain bodies. Priestley does not express anxiety about these obscure causes, however. Throughout his writings on electricity he is determined not to speculate beyond the evidence of his senses.¹⁷⁵

Though he is sceptical of Newtonian theories, Priestley models his practice on Newton because, unlike his followers, he advocated experimental rigour and was comfortable with provisional findings.¹⁷⁶ But despite his empirical methods, Priestley does speculate about the distinction between the electric fluid and aether: ‘Is there only one electric fluid, or are there two? Or is there any electric fluid *sui generis* at all, distinct from the ether of Sir Isaac Newton? If there be, in what respect does it differ from the ether?’¹⁷⁷ Priestley even asks, ‘May not the sun be the fountain of the electric fluid; and the zodiacal light, the tails of comets, the aurora borealis, lightning and artificial electricity as its various, and not very dissimilar modifications?’¹⁷⁸ For Priestley, as for Newton and his followers, electricity is perhaps diffused throughout the universe, but it is never a divine force, or an ‘active principle’.

This important distinction between Priestley's work and that of his contemporaries arises from his distinct account of matter, an account which has its origins in his electrical research.

Priestley publishes his first extended account of matter in his *Disquisitions Relating to matter and spirit* (1777) but explains that it was developed over several years, and that his remarks arise out of his experimental work as well as his engagement with common sense philosophy and the work of David Hartley.¹⁷⁹ Priestley acknowledges in his introductory essay to *Hartley's Theory of the Human Mind* (1775), that Hartley's work has proved hugely important for his thinking about matter.¹⁸⁰ He admits that Hartley's physiological model of thought will not 'satisfy those who are accustomed to consider all matter in the most gross and general manner' but insists that 'this system has been abandoned, in consequence of our becoming acquainted with the more subtle and important laws of matter... so now we see that the laws and affections of mere matter are infinitely more complex than we had imagined'.¹⁸¹ In the *Disquisitions* Priestley develops these claims, declaring he is

inclined to think, though the subject is beyond our comprehension at present, that man does not consist of *two principles* so entirely distinct from one another as *matter* and *spirit*, which are always described as having no one common property, by means of which they can affect... each other... I rather think that the whole man is of some *uniform composition*.¹⁸²

Priestley reflects on previous accounts, noting that 'spirit' is conventionally associated with thought, the 'higher orders of intelligent beings, and especially the Divine Being... said to be purely immaterial'.¹⁸³ Matter is assumed in contrast to exhibit '*solidity*, or *impenetrability*, and consequently a *vis inertiae*' as in the writings of Baxter and Newton. But Priestley insists that 'neither *matter* nor *spirit*... correspond to the definitions above mentioned'. He declares instead that 'matter is not that *inert* substance that it has been supposed to be; that *powers of attraction or repulsion* are necessary to its very being'.¹⁸⁴ For Priestley, matter is active and penetrable.¹⁸⁵ He denies that this is a controversial position, noting that Newton's account of active spirits leaves open the possibility of self-activating matter.¹⁸⁶ Priestley even observes that both Baxter and Berkeley agree that matter is penetrable, though they argue from an immaterialist position, but in contrast to their claims he insists that these powers are not added to matter '*ab extra*' but are '*self-existent* in it'.¹⁸⁷ Priestley leaves

the foundation of those powers a mystery, noting that ‘from whatever source these powers are derived, or by whatever being they are communicated, matter cannot exist without them; and . . . if that superior power, or being, withdraw its influence, the substance itself necessarily ceases to exist’.¹⁸⁸ He suggests that the ultimate cause lies with God, but insists that motion in matter is not the result of the ‘immediate agency of the Deity’.¹⁸⁹ If such phenomena have a divine cause, it is a mediated one.

Priestley’s work differs from that of many writers on electricity, but his claims for active matter may arise out of his electrical research.¹⁹⁰ He cites an experiment in which metal coins are electrified as evidence that matter is not impenetrable, and this notion of matter also, for Priestley, answers questions about the nature of electricity.¹⁹¹ He notes that ‘A spirit . . . [or] *immaterial substance*, in the modern strict use of the term, signifies a substance that has no *extension* of any kind . . . It has neither *length*, *breadth*, nor *thickness*; so that it occupies no portion of space.’¹⁹² This same reasoning suggests that electricity, which does occupy space, must therefore be material, as are the processes through which the mind thinks and reasons.¹⁹³ He denies that this radical materialism necessarily amounts to atheism.

It is only on account of the notion that matter is necessarily *inert*, and absolutely incapable of intelligence . . . that it has been deemed dangerous to ascribe it either to a finite, or to the infinite mind; but when this reproach is wiped away, the danger vanishes of course. It is the powers of supreme intelligence, omnipotence, unbounded goodness, and universal providence, that we reverence in the Deity; and whatever be the essence to which we believe these powers belong, it must appear equally respectable to us, whether we call it material or immaterial; because it is not the *substance*, of which we have no idea at all, but the *properties* that are the object of our contemplation and regard.¹⁹⁴

In the absence any knowledge of God’s action in the world, Priestley argues, we must reverence its effects.¹⁹⁵ He advocates the use of electricity as a tool, in chemical experimentation for example, suggesting that it can be of immense value even without detailed knowledge of the causes of its operation.¹⁹⁶ But despite his consistent claims for God as the first cause of electric and other natural phenomena, Priestley’s account of matter compromises the authority of God assumed in theories of Newtonian ‘active principles’.¹⁹⁷

In addition, Priestley's active matter changed the role of the experimenter or demonstrator who until then could present themselves as mediators of divine power.¹⁹⁸ Schaffer argues that by breaking the link between divine authority and natural philosophical phenomena Priestley's work paves the way for investigations of the causes of such phenomena by 'a group of lecturers and performers who explicitly used their work for new, radical purposes', bypassing rather than upholding divine authority.¹⁹⁹ I find this account of the political implications of Priestley's work useful, but even before Priestley's account of active matter, the authority of a divine 'first cause' of natural phenomena is always in question in electrical experimentation, because its powers prove so difficult to control. Natural philosophers, rather than operating as figures of authority are often marginalised in a range of ways, and in the face of the difficulty of explaining the wonderful range of electric phenomena they express a sense of impotence. But Priestley's ease at the thought of unknown causes and his new conceptualization of matter enable a more positive and a more explicitly political set of claims for the obscure operations of electricity. Adam Walker exemplifies this politicization of electrical aethers.

Priestley was an important influence on Walker, supporting and encouraging him at the start of his lecturing career; indeed Golinski reads Walker as an embodiment of Priestley's proselytising spirit in natural philosophy.²⁰⁰ But Walker also takes up Priestley's conception of matter and applies it in his lectures on electricity. Schaffer emphasises the political implications of this connection, noting how Walker engages with the concept of active principles, and uses them not to assert divine authority but 'to show an innate active power in human nature which resisted state power'.²⁰¹ The radical suggestions raised in Priestley's work on electricity and on matter thus find expression in Walker's experiments and lectures.

But, as he declares in the quotation at the opening of this chapter, Walker does not present himself as a thoroughgoing materialist. He notes of electricity that

Its power of exciting muscular motion in apparently dead animals, as well as of...reviving diseased vegetation, prove its relationship or affinity to the *living principle*. Though Proteus-like, it eludes our grasp; plays with our curiosity; tempts enquiry by fallacious appearances, and attacks our weakness under so many perplexing subtleties; yet it is impossible not to believe it the soul of the material world, and the paragon of elements!²⁰²

Walker, influenced by Priestley, Franklin and Newton, advocates empirical methods in the investigation of electrical phenomena, so his appeal to ‘the soul of the material world’ is surprising. The immaterial provenance of the soul sits awkwardly with these experimental methods and materialist ethos, but it is useful to Walker, because it acknowledges the way in which electrical phenomena exceed the limits of human faculties of sense, and because it suggests that even empiricists need to access a kind of faith in speculation. Conjecture is not a sign of experimental failure for Walker, but suggests mankind’s potential to unlock the mysterious operations of phenomena like electricity, and subject them to rules.

Walker’s phrase ‘the soul of the material world’ is distinct from other animistic language I have discussed. Fara notes that it is a ‘modified’ account of Berkeley’s model in *Siris*, and there are important similarities between them, but Walker departs from Berkeley and Freke by basing his claims on empirical data.²⁰³ In his *Analysis of a Course of Lectures* (1766), Walker declares that research should be confined ‘to *one single path*, namely that of *experiment*’.²⁰⁴ However, in the same lecture, he discusses phenomena that exceed the evidence of the senses. It is impossible, for instance, to measure the solar system. But Walker’s response is to declare:

Let us on the wings of imagination thus launch into the immensity of space, and behold the *system* beyond *system*, *above us*, *below us*, to the *east*, to the *west*, the *north*, the *south*! . . . Should not the narrow prejudices, the littleness of human pride, soften into humility at this thought?²⁰⁵

For Walker ‘imagination’ supplements but does not override sensory data. He applies the same methods to the study of electricity, conceiving of a form of fire that, like Newton’s aether, is diffused through space.

It is evident there is an *elementary*, (or, what is called *electric*) fire . . . inherent in most substances, and . . . conducted by them to any distance. Some say this fire is the cause of all motion; that the animal spirits are electric fire; that it is the soul of, and moves, the solar system, &c. Its properties and effects are truly wonderful, and are principally these.²⁰⁶

Walker echoes both Berkeley’s work and his own claim for electricity as ‘the soul of the material world’, but here he nuances that claim. Electricity is an ‘elemental fire’, a suggestion which aligns Walker’s work with ancient discourses of elementary fire. But it also recalls his celebration of electricity

as ‘the paragon of elements’. Electricity may be a ‘paragon’, but nonetheless it is an element, indicating its material provenance. And Walker departs further from predecessors like Berkeley with his promise to demonstrate these qualities through experiment. Despite Walker’s hint at its divine provenance, his assertion that electricity’s effects may be experimentally demonstrated again suggests that it is a material substance.

The power and obscurity of electricity seems to tempt Walker from his experimental observations into grander claims, which he acknowledges are difficult to prove:

The identity of fire, light, heat, caloric, phlogiston, and electricity, or rather their being but modifications of one and the same principle, as well as their being the grand agents in the order of nature; these are the leading problems of the work . . . Whether I am right or wrong in my ideas of them, I doubt not but they will have a fair and candid reading. The theory was not sought, but has obtruded itself through an experience of near forty years.²⁰⁷

Walker, like Priestley, resists hypothesis, but he does not see the uncertain status of electricity as a problem. Instead, he celebrates the way in which it exceeds human understanding, because it warns the philosopher of the dangers of hubris: ‘it gives an high, it gives a rational delight to the mind even to be lost in such excursions; for they teach us to be humble, they teach us to be wise; they teach us to be modest concerning our own abilities’.²⁰⁸ This obscurity also proves politically useful. Walker returns to Berkeley and Kinnersley’s hint that the limits of human understanding demand recourse to a kind of faith, but declares his faith in an earthly rather than a heavenly future state.

Schaffer interprets Walker’s lectures as evidence of a ‘shift’ in the logic underpinning natural philosophical research, from one that upheld ‘divine power’ to one which critiqued it. He argues that this shift occurred in the 1780s and 1790s, producing a suspicion of natural philosophers.²⁰⁹ Walker’s work, though, suggests that the radical implications of electrical demonstration and speculation were clear to its practitioners much earlier. In 1766 he publishes the first edition of his *Analysis of a course of lectures*, which also exhibits a clear critique of government. Walker uses a lecture on fortifications to launch an attack on the social formations which make such defences necessary. He declares that the ‘origine of governments’ is ambition, which ‘give[s] the designing *few* the first hint of usurping authority over the *many*’, and he lambasts this ‘multitude’ for allowing themselves

to be distracted from the serious task of protecting their interests.²¹⁰ Walker declares: ‘the soul of man [is] an active principle, full of design, forward to execute, and zealous after fame; qualities that are no friends to government’. Rulers realise this, and distract this ‘restless’ spirit by encouraging ‘longings after superfluous necessities’.²¹¹ Walker again refers to the soul, but to very different ends to Berkeley. The soul appears to be something like electricity, a ‘restless’, ‘active principle’ which is now ‘the soul of man’ not the ‘soul of the world’. Walker’s ‘active principle’ is not a medium of divine authority; it is a catalyst of human intellect and activity.

Walker’s account of electricity also recasts the soul of the world as a stimulus of anti-authoritarian activity. He makes electricity, which ‘Proteus-like . . . eludes our grasp [and] plays with our curiosity’, strikingly similar to mankind’s ‘active principle’ which resists government.²¹² Walker’s account of electricity points to the potential in human nature to resist government ‘decoy’. It also recalls denunciations of the evangelical spirit in America, which is ‘Proteus-like’ in its ability to propagate itself and to resist control. But Walker presents this subaltern spirit in a much more positive light, anticipating praise of Franklin’s mastery of an electric flame of liberty. His account recasts Berkeley’s sense of the soul of the world as ruling intellect, making such intellect latent and diffused, and capable of producing material change. Walker’s claim for the immanence of this active spirit in mankind in turn recalls Priestley’s account of active matter; it is not supplied from without, ‘*ab extra*’ from divine or earthly authority, but is innate. Even Walker’s use of animistic language points to such an understanding of matter. Electricity is not the ‘soul of the world’ but the ‘soul of the material universe’. Walker never speculates about the detailed implications of this statement; he makes no reference to spirits, vehicular states or other apparatus of the discourse of the soul. His interest lies in the material aspects of electrical display and the material effects of government on its citizens. His suggestion of an electrical vitalising principle is enormously powerful for both.

Despite the empirical and often materialist basis of electrical experimentation between the 1740s and 1770s, then, a language of spiritualised, even divine forces is a consistent element of electrical discourse. This language raises questions about scientific method, and religious faith, with which commentators grapple in a range of ways. Experimenters and philosophers are united by a sense that, like the divine power, electrical phenomena resist any clear demonstration of their causes, and thus necessitate speculation.

While almost every commentator follows Newton's call to base all hypotheses on experimental practice, the range of conclusions to be drawn from the effects of electrical experimentation results in a diverse array of speculations about 'imponderable', 'subtle' and 'active' quasi-material forces at play in electrical phenomena, many of which derive not from empirical scientific methods but from ancient accounts of spiritual forces. Two of these forces, the *anima mundi* and the aether, assume particular significance in the debates over the causes of electrical phenomena. They have distinct histories and suggest distinct qualities of electricity to those who employ them. But both demonstrate the peculiar status of electricity at this period, conceptualised so often as somewhere between a material and a spiritual phenomenon. While the *anima mundi* suggests an entirely spiritual phenomenon, and aether a potentially material one (however superfine and subtle), the application of both to electrical effects demonstrates the precarious nature of the distinction between matter and spirit. Franklin and Kinnersley seem less concerned than many of their contemporaries by such distinctions, and this confidence perhaps arises from their account of electricity as material, but also as itself a figurative phenomenon. Priestley's and Walker's accounts of electricity demonstrate new interpretations of matter and of spirit showing, respectively, that matter can be spiritualised and spirit can be materialised. Their assertion of an inherent active force in matter itself has important political implications, recasting the earlier attacks on such a 'spirit' as mere enthusiasm and anticipating later claims for electricity as a 'vital' property of a democratic, inclusive politics.

NOTES

1. Walker, *System of Familiar Philosophy*, 391.
2. Steven Shapin notes that models of matter and spirit are 'available for commenting upon the genus *hierarchy*'. Shapin, 'Social Uses of Science', 138.
3. See also Yolton, *Thinking Matter*, 103–104.
4. Baxter, *An Enquiry*, 1.
5. *Ibid.*, 6.
6. Shapin, 'Social Uses of Science', 136.
7. Baxter, *An Enquiry*, 11.
8. *Ibid.*, 13.
9. *Ibid.*, 14.
10. *Ibid.*, 36.

11. *Ibid.*, 37.
12. Heimann, 'Voluntarism and Immanence', 273–274.
13. Heimann, 'Nature is a Perpetual Worker'.
14. Heilbron, *Electricity*, 2. See in contrast Cantor, 'Theological Significance of Ethers'.
15. 'An Historical Account of the Wonderful Discoveries', 197.
16. *Ibid.*
17. Priestley, *History and Present State of Electricity*, 151.
18. Heimann, 'Nature is a Perpetual Worker', 2.
19. Schaffer, 'Natural Philosophy and Public Spectacle', 4.
20. Fara, *Entertainment for Angels*, 116.
21. Heimann, 'Nature is a Perpetual Worker', 5.
22. Schaffer 'Natural Philosophy and Public Spectacle', 5.
23. Cohen, 'Preface', xxxv–xxxvi. See also Cohen, *Benjamin Franklin's Science*, 14; and Cohen, *Franklin and Newton*, 120.
24. Newton, *Opticks*, 349.
25. Heimann, 'Nature is a Perpetual Worker', 5.
26. Newton, *Opticks*, 342.
27. *Ibid.*
28. *Ibid.*, 352.
29. Newton, *Mathematical Principles*, vol. II, 393.
30. Boas Hall and Hall, 'Newton's Electric Spirit', 473.
31. *Ibid.* See also Cohen, 'Preface', iv; Heilbron, *Electricity*, 239, 241; Home, 'Newton on Electricity', 191.
32. Home, 'Newton on Electricity', 207.
33. Newton, *Opticks*, 404.
34. *Ibid.*, 369.
35. Heimann, 'Nature is a Perpetual Worker', 2; Cohen, *Franklin and Newton*, 141. See also Rousseau, 'Nerves, Spirits and Fibres', 140; Roe, 'Life Sciences', 398–399, 405.
36. Cohen, *Franklin and Newton*, 177; Newton, *Opticks*, 399–400.
37. Newton, *Opticks*, 401–402.
38. Riskin, *Science in the Age of Sensibility*, 75.
39. Newton, *Opticks*, 403. See also Yolton, *Thinking Matter*, 94–100.
40. Heilbron, *Electricity*, 52.
41. Benjamin, 'Medicine, Morality', 172.
42. See Reill's discussion of the way in which occult phenomena were not banished by the influence of Newtonian thought. Reill, 'The Legacy', 28.
43. Benjamin, 'Medicine, Morality', 178; see also Cohen, *Franklin and Newton*, 161–162; Cohen, *Benjamin Franklin's Science*, 17.
44. Peter Collinson to Cadwallader Colden, 30 March 1745, cited in Schaffer, 'Natural Philosophy and Public Spectacle', 8.

45. Schaffer, 'Natural Philosophy and Public Spectacle', 496.
46. Cohen, *Franklin and Newton*, 173.
47. See Guest, *A Form of Sound Words*, 133–134 and 204–205 on Smart's objections to Newton's methods and findings.
48. Smart, *Poetical Works*, vol. I, 89. See also *ibid.*, 55.
49. Gibbons, *Spirituality and the Occult*, 42.
50. Fara, *Entertainment for Angels*, 120–121.
51. Myers, 'How Body Matters', 117; Benjamin, 'Medicine, Morality', 165–166, 169–170; Fara, *Sympathetic Attractions*, 27.
52. Benjamin, 'Medicine, Morality', 190. Walmsley disagrees, making Berkeley's aetheral spirit a combination of Newton's aether and Boerhaave's fire. Walmsley, *Rhetoric of Berkeley's Philosophy*, 168–169. Many electrical researchers conflated Boerhaave's fire and Newton's aether; see Heilbron, *Electricity*, 69, and Cohen, *Franklin and Newton*, 324.
53. Berkeley, *Works*, vol. III, 198–199.
54. *Ibid.*, 199, 227.
55. *Ibid.*, 199.
56. Benjamin, 'Medicine, Morality', 191.
57. Berkeley, *Works*, vol. III, 234.
58. *Ibid.*, 235–236.
59. *Ibid.*, 238.
60. Benjamin, 'Medicine, Morality', 190.
61. Berkeley, *Works*, vol. III, 231.
62. *Ibid.*, 257–258.
63. *Ibid.*, 206.
64. Chandler, 'Languages of Sentiment', 31. Chandler investigates how the 'vehicular hypothesis' is incorporated into and debated in the literary and philosophical works of Lawrence Sterne and Abraham Tucker in the later eighteenth century. *Ibid.*, 21–39.
65. Berkeley, *Works*, vol. III, 207. See Walmsley, *Rhetoric of Berkeley's Philosophy*, 166–167.
66. Walmsley, *Rhetoric of Berkeley's Philosophy*, 163–64; Myers, 'How Body Matters', 113–114, 120.
67. Berkeley, *Works*, vol. III, 214–215.
68. *Ibid.*, 207–208; see also Vassányi, *Anima Mundi*, 1–2.
69. Berkeley, *Works*, vol. III, 246; see also *ibid.*, 235–236.
70. Heilbron, *Electricity*, 55.
71. *Ibid.*, 68.
72. Worster, *Compendious and Methodical Account*, 29.
73. Robinson, *Dissertation on the Aether*, 138.
74. Heilbron, *Electricity*, 69. See also Heimann, 'Nature is a Perpetual Worker', 14.

75. Watson, *A Sequel*, 45–46.
76. *Ibid.*, 50–51.
77. *Ibid.*, 53.
78. *Ibid.*, 70–71.
79. It is not identical to the vital ‘*caliduminatum*’ of ancient philosophy, as Watson points out, *ibid.*, 75.
80. *Ibid.*, 72–75.
81. Wilson, *An Essay*, vi–vii, 53–54.
82. *Ibid.*, vii–viii.
83. *Ibid.*, 12–13.
84. *Ibid.*, 28.
85. *Ibid.*, 58.
86. Heilbron, *Electricity*, 296, 302, 378. See also Cohen, *Franklin and Newton*, 422.
87. Wilson, *An Essay*, 79–80.
88. *Ibid.*, 200.
89. Hoadly, *Observations*, 68.
90. Wilson, *Treatise*, 201.
91. Stewart, *Public Science*.
92. Rackstrow, *Miscellaneous Observations*, 6, 49–50.
93. *Ibid.*, 12–13.
94. *Ibid.*, 1–2.
95. *Ibid.*, 1–2, 26, 56.
96. *Ibid.*, 25–26.
97. Wesley in echoes of Berkeley and anticipation of Walker claims electricity as ‘the soul of the universe’, *Desideratum*, 9. See Fissell and Cooter, ‘Exploring Natural Knowledge’, 147–148; Bertucci, ‘Revealing Sparks’.
98. Lovett, *Subtil Medium Prov’d*, Preface, n.p.
99. Lovett, *Philosophical Essays*, v–vi. Lovett develops his claims in later text *The Electrical Philosopher*.
100. Lovett, *Subtil Medium Prov’d*, 5, 14.
101. *Ibid.*, 14–15, 16, 65–66.
102. ‘Sir Isaac Newton’s Aether Realized’.
103. *Ibid.*, 301.
104. Martin, *Philosophia Britannica*, Preface, n.p.
105. *Ibid.* See also Schaffer, ‘Consuming Flame’, 499.
106. Martin, *Philosophia Britannica*, Preface, n.p.
107. *Ibid.*
108. *Ibid.*
109. Schaffer, ‘Consuming Flame’, 506.
110. Freke, *Treatise*, vi. See also *ibid.*, 116, ii.
111. *Ibid.*, v–vi.

112. Lovett, *Philosophical Essays*, v–vi.
113. Cohen, *Benjamin Franklin's Science*, 19; Fara, *Entertainment for Angels*, 119.
114. Cohen, *Franklin and Newton*, 343, 345, 368, 424.
115. For Heilbron this is 'fortunate' as he takes a dim view of the philosophical value of that discourse. Heilbron, *Electricity*, 329–330. Cohen notes the importance of earlier responses to Newton by s'Gravesande, Desagulier and Hales for Franklin's conception of electricity. Cohen, *Benjamin Franklin's Science*, 19–20.
116. Chaplin, 'Benjamin Franklin's Natural Philosophy', 67.
117. Cohen, *Franklin and Newton*, 424.
118. Franklin, *Autobiography*, 185–186.
119. Kelleter, 'Franklin and the Enlightenment', 84.
120. Fothergill, 'Preface', 166.
121. Franklin, *Benjamin Franklin's Experiments*, 210.
122. Cohen, *Benjamin Franklin's Science*, 21. See also Cohen, *Franklin and Newton*, 107, 321–322.
123. Franklin, *Benjamin Franklin's Experiments*, 213.
124. *Ibid.*
125. *Ibid.*, 219.
126. Delbourgo, *A Most Amazing Scene*, 39.
127. Franklin, *Benjamin Franklin's Experiments*, 229.
128. *Ibid.*, 272.
129. *Ibid.*, 324–325.
130. *Ibid.* These remarks anticipate a later unpublished paper in which Franklin speculates about universal subtle fluid, but even there he does not refer to the fluid as aether. Cohen, *Franklin and Newton*, 340.
131. Cohen, *Franklin and Newton*, 346.
132. Franklin, *Benjamin Franklin's Experiments*, 327.
133. Cohen, *Franklin and Newton*, 287, 342.
134. *Letter to Benjamin Franklin*, 426, 432–433.
135. Reid-Maroney, *Philadelphia's Enlightenment*, 56.
136. *Ibid.*
137. Lemay, *Ebenezer Kinnersley*, 65.
138. *Ibid.*, 41.
139. Reid-Maroney, *Philadelphia's Enlightenment*, 54.
140. *Ibid.*
141. *Ibid.*, 57–58.
142. *Pennsylvania Gazette*, 11 April 1751.
143. For Delbourgo this uniting of reason and revelation is a characteristically American move. Delbourgo, *A Most Amazing Scene*, 141–143.
144. Kinnersley, *Course of Experiments*, 414.
145. Carroll and Prickett (eds.), *The Bible*, Genesis 2:7, 2.

146. Kinnersley, *Course of Experiments*, 418.
147. *Ibid.*, 421.
148. Reid-Maroney, *Philadelphia's Enlightenment*, 57.
149. Kinnersley, *Course of Experiments*, 421.
150. James Alexander to Cadwalader Colden, June 1752, quoted in Lemay, *Ebenezer Kinnersley*, 79.
151. *Pennsylvania Gazette*, 11 April 1751.
152. Kinnersley, *Course of Experiments*, 413.
153. Hall, *Contested Boundaries*; Mahaffey, *Preaching Politics*.
154. Kinnersley, 'A Letter'.
155. 'True and Genuine Account', 120.
156. *Ibid.*, 120–121.
157. *Ibid.*, 121.
158. *Ibid.*, 122.
159. Kinnersley, *Course of Experiments*, 6.
160. Delbourgo, 'The Electrical Machine', 266.
161. Golinski, *Science as Public Culture*, 68.
162. McEvoy and McGuire, 'God and Nature', 326.
163. 'The History and Present State of Electricity', 464. See Golinski, *Science as Public Culture*, 73.
164. Priestley, *History and Present State*, xi.
165. *Ibid.*, vi–vii.
166. *Ibid.*, xviii. David Hartley is Priestley's example of a pious philosopher, *ibid.*, xix.
167. *Ibid.*, 408.
168. McEvoy and McGuire, 'God and Nature', 329.
169. McEvoy, 'Electricity, Knowledge', 19.
170. *Ibid.*, 64–65.
171. *Ibid.*, 15.
172. In his *Familiar Introduction to the Study of Electricity* Priestley uses the three terms interchangeably. Joseph Priestley, *Familiar Introduction*, 82–83.
173. Priestley, *History and Present State*, 415.
174. *Ibid.*, 424.
175. McEvoy, 'Electricity, Knowledge', 12.
176. Priestley, *History and Present State*, 446, 530–531.
177. *Ibid.*, 449.
178. *Ibid.*, 450.
179. Hartley too was interested in the material and spiritual basis of electricity, basing his account on Newton's aether. Fulford, Lee and Kitson 'Man Electrified Man', 184.
180. McEvoy and McGuire, 'God and Nature', 350.
181. Priestley, *Hartley's Theory*, xvii.

182. Priestley, *Disquisitions Relating to Matter and Spirit*, xiii. Priestley is sceptical about a ‘vehicle’ that mediates between the spiritual and material, arguing that there is no distinction between matter and spirit, *ibid.*, 16–17, 61, 74. See also Yolton, *Thinking Matter*, 114; McEvoy and McGuire, ‘God and Nature’, 330.
183. Priestley, *Disquisitions Relating to Matter and Spirit*, xxxvii.
184. *Ibid.* See also *ibid.*, 16; McEvoy and McGuire, ‘God and Nature’, 384. Nonetheless as Yasmin Solomonescu notes Priestley’s position is ‘rare among late eighteenth-century natural philosophers’. Solomonescu, *John Thelwall*, 18.
185. Yolton, *Thinking Matter*, 112.
186. Benjamin, ‘Medicine, Morality’; 172, McEvoy and McGuire, ‘God and Nature’, 387.
187. Priestley, *Disquisitions Relating to Matter and Spirit*, 7, 8, 17, and Priestley *An Examination of Dr. Reid’s Inquiry*, 54.
188. Priestley, *Disquisitions Relating to Matter and Spirit*, 7.
189. *Ibid.*, 9.
190. McEvoy suggests, though, that Priestley avoids a reliance on obscure causes in his theory of matter, ‘Electricity, Knowledge’, 18–19.
191. Priestley, *Disquisitions Relating to Matter and Spirit*, 12–13.
192. *Ibid.*, 54.
193. McEvoy and McGuire, ‘God and Nature’, 386.
194. Priestley, *Disquisitions Relating to Matter and Spirit*, 109.
195. McEvoy and McGuire, ‘God and Nature’, 336, 339.
196. Priestley, *History and Present State*, 562–563.
197. Shapin, ‘Social Uses of Science’, 117–118.
198. Schaffer, ‘Priestley and the Politics of Spirit’, 41–42.
199. *Ibid.*, 41.
200. Golinski, *Science as Public Culture*, 8.
201. Schaffer ‘Priestley and the Politics of Spirit’, 41.
202. Walker, *System of Familiar Philosophy*, 391.
203. Fara, *Entertainment for Angels*, 121.
204. Walker, *Analysis of a Course of Lectures*, 3.
205. *Ibid.*, 8.
206. *Ibid.*, 41.
207. *Ibid.*, xi.
208. *Ibid.*, vii.
209. Schaffer, ‘Priestley and the Politics of Spirit’, 42.
210. Walker, *Analysis of a Course of Lectures*, 58.
211. *Ibid.*
212. *Ibid.*

Electrical Medicine, Feeling and Eroticism

The body is a crucial instrument in eighteenth-century electrical experimentation, and electricity is immediately understood as affecting the body too. Despite worries about electricity's lack of utility, practitioners use it for medical treatments from the 1740s onward.¹ However, the somatic basis of electrical practices proves a challenge for those who would regulate and systematise electrical science. As Delbourgo notes, electrical experiments 'engaged the passions as well as the rational faculties . . . because there was no physical separation between the experimenter and the phenomenon under observation, distinguishing external causes from ones originating only in the mind, often proved difficult, if not impossible'.² Schaffer, too, has noted that though experiential data were crucial to claims for empirical rigour in experimentation, natural philosophers had to perform a rhetorical sleight of hand in which the evidence of their own body stood in for 'the collective [body] to which they belonged and from which they drew authority'.³ Electrical experiments in which the body of the perceiving subject was also the object acted upon, were seen to produce suspect evidence. And electric therapies too were compromised by the difficulty of explaining just how they effected their cures. In this chapter I take up Delbourgo and Schaffer's sense of the centrality of the body in electrical practices, using their cue not just to interrogate issues of perception and knowledge-making but also to explore another aspect of electrical physicality, the connection between electricity, health and sexual attraction.

From the moment that electrical experimentation and treatments capture public interest in the 1740s, writers begin to use electrical imagery to talk about sex. John Cleland in *Memoirs of a Woman of Pleasure* (1749), for example, refers to ‘that principle of electricity that scarce ever fails of producing fire when the sexes meet’.⁴ But this figurative play is closely related to the epistemological problems raised by the body in electrical experiments and treatments. Delbourgo notes that experimenters’ focus on somatic experience means that ‘many regarded reason as only one instrument through which embodied selves came to know the external world – an instrument that necessarily functioned in concert both with the senses and the faculty of imagination’.⁵ In addition, electrical ‘cures’ were often pronounced purely the result of a placebo effect upon gullible patients. The relationship between reason, the senses and the imagination was not always clear; however, Delbourgo argues, given the somatic basis of electrical practices, experimenters could not ignore the possible influence of the imagination on their senses.⁶ Imagination was not presented purely as a problem, a distorter of reliable ‘fact’, but rather as an aspect of the ways in which electrical experiments operated on the ‘uncertain boundary between the work of experiment and the pleasure of play’.⁷ Delbourgo’s emphasis on play is important for thinking about the imagination in electrical experiment. I discussed in [Chapter 1](#) how often electrical displays incorporated elements of play, and Karen Harvey has noted how such play was sexualised, from the Venus kiss to the drawing of electrical sparks from whalebone corsets, and has traced an important connection between electrical experiment and erotica at this period.⁸

I build on Harvey’s work to argue that the metaphorical connection between electricity and sex has its origins in the physical gestures and bodily basis of electrical experimentation. But just as important for the writings that associate electricity and sex is electricity’s disruption of the evidence of the senses, which demands recourse to the imagination. In many electrical experiments, and in their figurative appropriations, the way electricity can be felt but not described connects it with the experience of sexual attraction. And the lack of an agreed vocabulary for such experience necessitates the work of the imagination. This connection works in two directions, as some commentators also suggest that the physical effects of electricity are purely imaginary or fantastical. But the association between electricity and sexual connection is not purely a titillating or bawdy one. Electricity’s somatic functions make it possible for practitioners to develop claims for its therapeutic value, and to suggest that electricity is the principle

of vitality. This conceptualisation of electricity as health-giving runs through even the lowliest accounts of the ‘principle of electricity’ produced ‘when the two sexes meet’. In this chapter I investigate a set of erotic satires of electrical experimentation, and move to more sustained examinations of the connection between electricity, sex and health in the works of William Stukeley, Franz Anton Mesmer and James Graham. I conclude by thinking about a more clearly metaphorical appropriation of electricity as both a sexual and health-giving force, and examine the way in which the poets Robert Merry and Mary Robinson politicise such images in the 1790s, to make electricity a figure of revolutionary, salutary fellow feeling.

1 WILLIAM STUKELEY

In the 1740s, the connection between electricity and sexual performance is made in erotic texts which emphasise their own transgressiveness, though as Harvey notes, such texts were closely tied to ‘contemporary medical and scientific concerns’.⁹ A scurrilous pamphlet of 1745, *The Teague-root display’d*, which argues that electricity is the source of erotic attraction, begins by satirising William Watson’s activities at the Royal Society. It ironically praises Watson’s ‘useful Discoveries and Improvements’, celebrating ‘that wonderful Experiment of yours, by which you have taught them, that Spirit of Wine, or any other Proof-Spirit, is to be fired with one’s Finger’.¹⁰ There is certainly a connection between the perceived inutility of electricity and the masturbatory emphasis of this erotica. But the pamphlet goes on to argue for the correlation between the gestures of electrical experimentation and erotic practices. Both male and female genitalia are represented as electrical instruments, as the text closely models electrical experiments in the Royal Society’s *Philosophical Transactions*: ‘let one of the nicest ladies take a male-root into her hand, and she becomes instantly electrical, and you may observe the quick and sudden flashes of electrical fire dart from her eyes: the flashes are more frequent and much more discernible than those from the highest electrified tube’.¹¹ Throughout the *Teague-root display’d*, arousal itself is ‘electrical’. But it is not clear whether the onlooker, observing the ‘electrical fire dart from [the lady’s] eyes’, sees a visible spark, or feels an attraction akin to electricity, or both.

This uncertainty is mirrored in the texts which are the satirical targets of the *Teague-root display’d*. As I discussed in [Chapter 2](#), Ebenezer Kinnersley promises in his lectures to demonstrate ‘Spirits kindled by fire

darting from a lady's eyes (without a metaphor)'.¹² Kinnersley suggests that 'electric fire' is not a figurative image of sexual attraction but a manifestation of the erotic power of the female gaze. Harvey notes the degree to which eighteenth-century erotic discourse employs a metaphorical register; indeed she defines erotica itself as '*material about sexual pleasure [in] which bodies were represented through metaphor and suggestion, and depictions of sexual activity were characterized by deferral and silence*'.¹³ This distancing effect is clear in the *Teague-root display'd* and in other electrical erotica from the period; by apparently describing electrical experiments, the pamphlet is enabled to say a lot about sexual intercourse. But the importance of electrical images in this pamphlet goes beyond the alibi of the extended metaphor. It also touches on the way in which electricity itself is conceived as a quasi-metaphorical phenomenon. The *Teague-root display'd* does not just satirise contemporary electrical experimentation; rather, it builds its case on the same assumptions as its natural philosophical sources about the obscurity of electricity.

Such obscurity is apparent in the work of William Stukeley, another Royal Society member who engages with electricity in the late 1740s. Stukeley is best remembered as an antiquary who worked on the druidic sites at Avebury and Stonehenge, but he also followed closely the electrical experiments of the Royal Society. He comments on 2 March 1749 that 'Mr Watson apothecary gave a curious paper concerning electricity, and the news he had received lately from abroad, about it'; this is William Watson, satirised in the *Teague-root display'd*.¹⁴ Stukeley used his electrical knowledge to develop a theory of the electrical origin of earthquakes, published in the *Philosophical Transactions*, but in both his published and unpublished papers, he connects the geological operation of electricity with its physiological function.¹⁵ He observes in October 1750 that 'this electrical motion which is the cause of . . . earthquakes, has a similar effect, as in electrical experiments of inducing a sickness upon weak and tender constitutions'.¹⁶ In his *Philosophical Transactions* paper 'The Philosophy of Earthquakes', Stukeley develops his claim that electricity affects both inanimate and animate matter; but he is frank about the limits of his knowledge, declaring, 'we know not the immediate mode of muscular motion, any more than we know how, in inanimate matter, it causes the vibrations of an earthquake'.¹⁷ Throughout his writings, Stukeley maintains that the causes of electrical phenomena are obscure, but this does not prevent him drawing conclusions about its effects.¹⁸ He continues to

insist on the connection between the electrical power that causes earthquakes, and the physiological function of electricity, but focuses increasingly on the latter, even arguing that ‘All motion, voluntary and involuntary, Generation, even life itself . . . and an infinity more of nature’s works, are owing to the activity of this electric fire, the very soul of the material world.’¹⁹ In his notebooks, Stukeley develops his claims for the importance of electricity for fertility, declaring that electricity ‘is the principle of all generation in animals. The . . . action is purely electrical, as is the impregnation of the ovum of the female, which contains the embryo.’²⁰ Stukeley’s reference to ‘the soul of the material world’, the *anima mundi*, aligns his claims with ancient philosophical traditions, and with the philosophy of George Berkeley.²¹ But his description of the sexual act as well as the moment of fertilization in electrical terms seem much closer to the claims of the *Teague-root display’d*, and other electrical erotic writings.

Stukeley never publishes his suggestion of the electric basis of sex, but in his notebooks from 1754 he produces a detailed electrical theory of fertility and of sexual intercourse. In his ‘Golden Kalendar’ of that year Stukeley distinguishes his meetings with a women referred to as M, from those with his wife.²² His notes on electricity and sex appear to be a philosophical justification for seeking happiness outside of marriage, ‘for one great purpose of philosophy is to obtain such a command over our passions and affections as to lead us to that happiness destined for us here, by providence’.²³ It is in this context that Stukeley moves to a discussion of ‘the commerce between the two sexes’, arguing that ‘the action is natural and can’t be criminal, but as circumstanced’.²⁴ He employs electricity to support his case for the naturalness of the sexual act, declaring: ‘electricity is a kin to the nervous system. It puts all things into a state of vibration’, which is a healthy state.²⁵ Stukeley focuses on health in his justifications throughout these notes, but supports these claims by pairing them with the ancient philosophical systems that underpin his theory of earthquakes:

Now the commerce between the sexes is really an electrical operation in all respects. The preparatory dalliance, and the consummation. Which latter is analogous to the shock. So where attraction ends repulsion begins.

Such is the nature of that great soul of the material world, electricity. Tis truly what we call the animal sprits, a mediator between material and immaterial, the cause of action and conservator of the great mundane frame . . .

We see Virgil the philosopher know of this principle . . . and we see the beauty of the conjugal endearment, at first going to bed and falling asleep after it, with consummate pleasure.²⁶

Electricity's mixed operations allow Stukeley to appropriate it in various ways. First, as in the *Teague-root*, electricity explains attraction, arousal and even the 'shock' of consummation. But it is also the universal 'mediator between material and immaterial', which enables life itself, and which promotes a general state of health 'by giving and preserving to the nerves, their proper tone, and tension'.²⁷ Stukeley works hard to make his claims respectable, but gives himself away in the remarks that end this passage. The 'philosopher' may be aware of this electrical theory of life and health, 'but the vulgar cannot be accounted sufficient for these things, and the philosopher alone is capable of conducting them properly, to their destined end: and without disturbing the harmony of the world'.²⁸ Stukeley signals the generic instability of his treatise here; the 'philosophy' of his notebooks would revert to bawdiness in the hands of a different audience. But there is also a political edge to Stukeley's concern; he worries that this knowledge in the hands of the 'vulgar' could indeed disturb 'the harmony of the world'.

The susceptibility of the 'vulgar' to unorthodox notions of the connection between electricity, sex and health becomes clear in another case from the 1740s. Stukeley may have had this case in mind in 1754, because he witnessed and reported the Royal Society's discussion of it in his notebooks of 1749. In the notebooks Stukeley describes Italian researchers' claims for 'the effluvia of medicinal substances passing through the tube into the human body, and having considerable effects thereon'.²⁹ Gianfrancesco Pivati of Venice claimed to have developed a new form of electrical medicine, as Paola Bertucci describes:

Sealed glass tubes, filled with perfumed substances, when rubbed on their outer surface, became in the hands of the Italians as permeable as sponges. The electric vapours excited by the rubbing made the perfumed particles evaporate through the pores of the glass into the spectators' nostrils. If medicaments were put inside the tubes, patients would be instantly cured simply by breathing the electric effluvia.³⁰

This use of electricity as a medium for other medicinal substances was unprecedented, and Jean-Antoine Nollet, a leading practitioner of medical electricity in France, was determined to repeat the experiment. However, his

attempts to achieve the same effects as Pivati and his colleagues failed. In 1747 Nollet travelled to Italy in the hopes of either succeeding there, or of uncovering quackery. He reported his findings to the Royal Society in London, as Stukeley notes:

They had many meetings with diverse philosophers: they formally try'd all electrical experiments on themselves and others, holding saffron, jalap, rhubarb in their hands: this they did repeatedly several days but no effect produced.

He went to signor Pivatti at Venice, to Bologna and to divers other cities [sic] in Italy . . . He conversed with all the philosophers, he interrogated all the patients he could meet withal . . . The event was, that there could be no sufficient ground to believe that any medicinal substances, any odoriferous ones would transmit their volatile parts through the electrify'd tube: so as to affect the human body. Nor that any patients were actually recovered thereby. The professors themselves had been too credulous in the affair, and through a desire that the matter should be true, had made too hasty conclusions.³¹

Nollet's work, as Bertucci has shown, was itself indebted to a culture of curiosity and wonder, but he condemned the 'quackery' practiced by Pivati and his colleagues, because it led the science of electricity too far into the realm of conjecture.³² But though Nollet and the Royal Society members condemn the credulity of the Italian experimenters and their patients, the Pivati case is an important influence for Stukeley, because it signals how electricity is so imperfectly defined that it can be difficult to distinguish from purely imaginary effects. Stukeley's later writings on electricity and sex retain the connection between electrical science, health and fantasy, and this connection is again clear in another cluster of texts produced in the 1770s, in particular the work of James Graham.

2 JAMES GRAHAM

During the 1770s, two controversial therapeutic practices were associated by practitioners and critics with electrical medicine. These were Franz Anton Mesmer's animal magnetism, and the electrical therapies offered by James Graham through the use of his celebrated 'celestial bed', an electric bed designed to aid conception. Mesmer's and Graham's practices have much in common, as Lydia Syson notes:

Both introduced ideas that were original enough to amaze and impress but close enough to mainstream understanding not to be dismissed out of hand.

Both understood the use of drama, and made persuasive appeal to their patients' sense and imagination. They also both believed they could control or channel natural phenomena.³³

As Syson suggests, both Mesmer and Graham exploited the connection between electricity, health and sex proposed in the 1740s. Their claims for this connection rest, like Stukeley's, on the understanding of electricity as a universally diffused animating spirit. Mesmer proposed that animal magnetic attraction proceeded from a 'universally distributed and continuous fluid . . . of an incomparably rarefied nature', while Graham claimed that his celestial bed 'combined aethereal, magnetic, musical and other irresistibly animating and invigorating influences with the electrical fire'.³⁴ Mesmer's and Graham's practices strengthened perceived connections between electrical communication and eroticism, but both men also drew on a tradition of electrical medicines, and democratic treatments that were available to all.³⁵ In his *Mémoire sur la découverte du Magnétisme Animal* (1779) Mesmer insists that his aim is to 'scatter the clouds and shed light on this important truth: that NATURE AFFORDS A UNIVERSAL MEANS OF HEALING AND PRESERVING MEN'.³⁶ While both Mesmer's and Graham's treatments are erotically suggestive, this suggestiveness is intrinsically linked to their medical claims.

There were, however, important distinctions between Mesmer's and Graham's practices. They theorized their treatments in very different ways, and as Syson notes, their reputations and legacies were distinct: in comparison with Mesmer's enormous success, 'Graham was a far more isolated and eccentric figure'.³⁷ In contrast to Mesmer, Graham's work has received relatively little critical attention, so I make it my focus in this chapter. But one element of Mesmer's practice is particularly important for any reading of Graham's work, namely the significance of the imagination in animal magnetism. Discussions of the imagination lie at the heart of both celebrations and critiques of mesmerism, and these discussions provide a useful frame through which to read Graham's work.

By the early 1780s, Mesmer's animal magnetic practice in Paris had proved so successful, and so controversial, that a Royal Commission was formed to test the scientific basis of mesmeric treatments, led by Benjamin Franklin. As Riskin notes, the commissioners were placed in a difficult position. It was hard for them to dismiss Mesmer's claims to have harnessed an invisible 'universal fluid', because these claims were very similar to 'legitimate' theories about the causes of the phenomena of electricity as

well as magnetism, heat and other ‘imponderable fluids’.³⁸ In response, the commissioners declared that the effects of mesmeric treatment were not evidence of a universal fluid, but resulted from the overactive imagination of Mesmer’s patients.³⁹ But the result of this assertion was that in the commissioners’ *Report* the imagination became an overwhelming force, ‘that active and terrible power, by which are operated the astonishing effects, that have excited so much attention to the public process’.⁴⁰ Riskin notes that though the *Report* succeeded in discrediting Mesmer, it also established a new theory of the influence of the imagination on the body. ‘It was the commissioners who extracted from mesmerism a new and radical force, the power of imagination: an immaterial force capable of causing physical sensations.’⁴¹ This was not the first time that the imagination had been cited as the cause of ‘miraculous’ cures. Schaffer notes the connection between the Mesmer controversy and Nollet’s dismissal of Pivati’s cures in the 1740s as ‘a sign of the effects of the power of overwrought imagination’.⁴² But there are interesting connections between Pivati and Mesmer’s practices which extend beyond criticisms of them as quackery.

Both cases break down the distinction between electricity’s ‘material’ and ‘imaginary’ effects, because the operations of the imagination are theorised in strikingly similar ways to those of electricity. As Schaffer notes, the commissioners located ‘the seat of the imagination in the body . . . in the eyes’.⁴³ The *Report* emphasises ‘the power, which the sense of sight exercises over the imagination . . . The eyes possess in an eminent degree the power of magnetising . . . The reason is very simple; it is the eyes that convey the most energetic expressions of passion.’⁴⁴ The commissioners’ words echo both experimenters’ and satirists’ celebration of the erotic power of the gaze, and Kinnersley’s need to stress that ‘the fire darting from a lady’s eyes’ is real. This suggests an interesting corollary to the commissioners’ dismissal of animal magnetism. While the quasi-electric effects of Mesmer’s fluid could be merely imaginary, the *Report* raises the possibility that the imagination itself has a material effect, which might be theorised in a similar fashion to electricity. Graham’s therapeutic practice provides another example of the importance of the imagination in the connection between electricity, sex and health. But in contrast to accounts of animal magnetism in which the imagination is an alternative cause of mesmeric phenomena, Graham presents electricity and the imagination as supplementing one another, and operating as a single cause of his electric cures.

Graham was notorious in his lifetime, but as Roy Porter notes, his notoriety has done him a disservice, as he ‘lends himself so readily to

labelling that he has been little explored'.⁴⁵ This critical neglect has in many respects been righted; Porter and Patricia Fara have shown how Graham's practice can be aligned with 'Enlightenment values' in philosophy and in medicine, and Peter Otto has drawn attention to Graham as a performer, focusing on his techniques and the spaces within which he worked.⁴⁶ But studies of Graham still tend to discuss him as an anomaly, whereas the connections between his work and that of his contemporaries are striking, and require further investigation. So here I take seriously Graham's self-presentation as an expert in electrical science. I suggest that despite the dismissals of Graham as a quack, his methods are not far removed from those of other electricians. Rather than legitimising Graham's practice, this connection demonstrates the potentially impolite nature of all electrical science, and the ease with which it can be appropriated in erotic writings such as the *Teague-root displayed*. I focus on Graham's theorisation of the operation of electricity, in particular its effects on the human body in his therapeutic practice. Graham embraces the suggestion of the importance of the imagination in electrical cures, and his focus on imagination, even fantasy, becomes particularly important in his treatment of sexual dysfunction, through the use of his 'celestial bed'. Graham's disreputable practice is fascinating in its own right, but it also reveals the extent to which the imagination and fantasy inform all electrical work. The vigour and the venom with which Graham's work was attacked by satirists and 'respectable' practitioners suggest that they too were aware of the threat of the close relation between Graham's 'quackery' and other electrical practices.

Graham makes extravagant claims for the electrical equipment he has assembled at his treatment centres, the Temples of Health and Hymen:

Most of the electrical apparatus which I have seen in the world . . . are mean, awkward, and contemptible; but at the same time good enough for the childish, nonsensical tricks that are generally played with them . . . on the contrary, the apparatus which I have had the honour of constructing, daily proves itself worthy of ranging among the most valuable of all the acquisitions, which in ancient or in modern times have enriched medicine, or dignified the healing art!⁴⁷

In contrast to the frivolous 'nonsensical tricks' of most practitioners, Graham's equipment has powerful utility in 'the healing art'. His dismissal of public electrical experimentation is an important rhetorical move. In the

very act of distancing himself from such ‘tricks’, Graham tacitly admits that his practice will be consumed and judged as a spectacle. He is hardly alone in negotiating the relation between his practice and the trade of ‘showmen’, as the example of Benjamin Martin demonstrates. But the metaphorical association between electricity and theatricality had strengthened in the thirty years between Martin’s lecturing career and that of Graham.

Many accounts of the theatre from the 1770s to the 1790s evoke the connection between the affective power of performance and the electrical shock. In 1769 David Garrick demanded that performers’ genius should ‘like electric fire, shoot through the veins, marrow bones and all of every spectator’, and the metaphor is found repeatedly in theatre reviews in succeeding decades.⁴⁸ The actress Dorothea Jordan seems to have particularly often been praised for such electrical effects. In 1789 she addresses the audience directly after an interruption, and as the reviewer of *Woodfall’s Register* notes, ‘the effect was, as may readily be supposed, electrical; and even the envious few were compelled to join in the general and continued plaudits’.⁴⁹ During a 1797 production of *Rule a Wife and Have a Wife* at Drury Lane, the reviewer of the *Whitehall Evening Post* notes, ‘there is a playfulness in her mirth so catching and electrical that it spreads itself over the house, and communicates its sympathetic affection to every bosom’.⁵⁰ Of course, this association with the theatre, and with the affective power of the performances of actresses in particular, did not aid the respectability of electrical experimentation. But Graham has a rhetorical knack for exploiting electrical spectacle and the commercial opportunities it presents, while claiming a philosophical and therapeutic high ground.

In the accounts of his education and career in two of his earliest works, *A Short Inquiry into the Present State of Medical Practice* (1776), and *The General State of Medical and Chirurgical Practice, Exhibited* (1779), Graham aligns himself with the practice of ‘philosophers, physicians’ and practitioners of ‘philosophic chemistry’.⁵¹ Though these texts are published less than ten years after the events described, Graham liberally rewrites his history. He remarks that after completing his medical training at the University of Edinburgh, he travelled and worked in America until 1774. It was in America that he apparently first encountered electricity, through the practice of experimenters like Kinnersley and Franklin.⁵² Graham seems to have picked up a working knowledge of electricity, and worked as an itinerant electrical healer in the colonies.⁵³ But in retrospect, he presents his American career as a scientific

apprenticeship, deliberately sought out: ‘I knew that in *Philadelphia* Electricity had been more improved, was better understood, and more generally cultivated than in any other part of the world . . . I embarked, accordingly . . . for America.’⁵⁴ Graham later augments this account, implying that he had studied at the feet of Franklin: ‘It was in Philadelphia! The capital city of the infant queen of empires! Where I had the good fortune of studying electricity two years, profiting by the labours of the great prince of philosophers! . . . the venerable prince of politicians!’⁵⁵ Graham, like many contemporaries, connects Franklin’s mastery of electricity with his catalysing of revolutionary spirit in America, but Franklin’s significance for Graham’s narrative is as an electrical expert, whose proficiency he emulates.⁵⁶ Thus co-opted, Franklin joins the ranks of the medics and natural philosophers Graham claims as his forebears in the *Short Inquiry*, including the Edinburgh luminaries John Hunter, William Cullen, Robert Whytt and Joseph Black, as well as ‘the great, judicious and indefatigable Dr Priestley’.⁵⁷ Priestley is the only electrician named by Graham; he implies that he will build on the work of his influences by combining their medical with his electrical expertise. In *The General State*, Graham declares: ‘Would to God! that a Franklin! – a Priestley! And several other great and learned men I could name, had been practising Physicians! What might not be expected from the indefatigable labours of such bright and penetrating intelligences?’⁵⁸ Graham makes himself the man to fill this need by applying electrical practice to medical science.⁵⁹ He co-opts the authority of the most celebrated electricians, but reserves the application of electrical research to medicine as his own expertise.

Graham grounds these claims in his experimental practice, again aligning his work with the empirical methods of natural philosophers.⁶⁰ He warns of the dangers of electricity in the hands of ignorant practitioners:

I tremble with apprehension for my fellow creatures, when I see in almost every street in this great metropolis a barber – a surgeon – a tooth-drawer – an apothecary, or a common mechanic turned electrical operator. How dangerous! How ridiculous! must it be in most cases to venture so curious – so complex and so delicate a machine as the human body . . . shook, torn and convulsed with the ignorant and improper application of this awful element!⁶¹

Again, Graham refers to commercial electrical practices in order to distance himself from them. In contrast, he notes, ‘I have been taught by

reason and by the most attentive observations in innumerable experiments on almost every substances in nature, and in a course of practice in diseases far more extensive than that perhaps of any other man in the world.⁶² Graham's empirical methods form the foundation of his practice, as he reiterates in several later texts.⁶³ Like his natural philosophical forebears, Graham insists, his proficiency is based on experiment and observation, but he departs from them in converting this practice into a spectacular commodity.

Graham's genius for preserving the recognisable techniques and equipment of electrical experimentation, but transforming them into theatre, is clearest in his description of the newly established Temple of Health. In the *Sketch: or, short description of Dr Graham's medical apparatus*, Graham walks his reader room by room through the Temple, his lavish treatment centre, medical laboratory and the stage set for his healing acts. He boasts that he is using the most celebrated 'medico-electrical apparatus', describing 'two cylinders of brilliant glass, and of prodigious size' which are 'the same with which the electrical experiments were exhibited two years ago in the Pantheon in Oxford Street before his Majesty! – the Royal Family! – the Royal Society, &c', a reference to the spectacular experiments of Benjamin Wilson, produced to show the best design for lightning rods in 1777.⁶⁴ Graham's mention of the Pantheon situates his practice at the heart of fashionable metropolitan display; as Gillian Russell notes, the Pantheon had a 'dazzling impact' when it opened in the early 1770s, producing a form of spectatorship which enabled 'the eroticization of both the building and the bodies it displayed'.⁶⁵ Graham develops a similar sexualised culture of display at his Temple. In typical style he claims since Wilson's machines 'became my property, I have improved them exceedingly' by making them even more spectacular.⁶⁶ Graham's description of the 'Apollo apartment', the centrepiece of the Temple of Health, demonstrates his mastery of such spectacle. He describes standard electrical equipment, adapted to emphasise its spectacular effects. One room contains 'a fiery dragon, no less than six feet in length, double gilt... Its wings are expanded, its eyes blaze with electrical fire, it appears flying through the luminous atmosphere.'⁶⁷ But he also explains how he achieves this effect: the dragon is supported by 'a large massy tube of pure flint glass', which is itself connected to 'a noble cylinder, of pure snowy white enamelled glass, highly polished, and of prodigiously large dimensions', in other words, a giant Leyden jar which stores the electric charge that

powers the dragon. The circuit is completed and ‘the lambent elementary fire . . . is communicated to every part of the apparatus by the tail of this tremendous animal, which rests on one end of the prime conductor’.⁶⁸

In his account of the treatments carried out in the Temple of Health, too, Graham stresses the connections between his practice and contemporary electrical research. One treatment involves the use of a ‘magnetic crown’:

This crown is occasionally removed, and reservoirs or tubes are attached, from which drop, or rain, or run by the force of air, electricity, or magnetism, or by the united power of the three, aetherial essences, nourishing dews, vivifying attractive or repellent effluvia and influences – while from innumerable points flows a glory, or seeming beatification, from the celestial or elementary fire upon the patient.⁶⁹

Though this ‘beatification’ sounds almost mystical, Graham stresses that the crown is activated by electricity conducted from a ‘groupe of massive brass rods [which] pierce the dome’ of the Temple, and are themselves charged by ‘the tremendous metal conductors on the top’.⁷⁰ This set-piece gestures to notorious electrical experiments by Georg Matthias Bosc and Benjamin Rackstrow in the 1740s, but Graham, in contrast to Bosc and Rackstrow, carefully explains how he achieves those effects. Graham’s Temple certainly tends to the marvellous, but this does not disqualify his work from the discourse of contemporary electrical science. Rather it demonstrates how all electrical demonstration tends to the spectacular.

Until the opening of the Temple of Hymen in 1781, Graham’s therapeutic claims relate to general health rather than sexual dysfunction and fertility.⁷¹ Just as the ostentatious spectacle of Graham’s Temple of Health highlights the theatrical nature of all electrical science, his claims for his health treatments have much in common with orthodox medical practice at this time. Syson notes, ‘the lack of consensus about how electrical therapy actually worked . . . largely reflected a lack of consensus in the medical profession about how the human body itself worked’.⁷² Graham’s claims for his electrical therapies are often vague and presumptuous, but as Fara notes ‘there were no hard boundaries . . . between Graham and eminent society physicians coming from a more conventional background’.⁷³ The obscure workings of his electrical treatments have much in common with the therapies offered by physicians and quacks alike.

But even when professing his expertise, Graham hints at the connection between electrical science and sex. This suggestion is clear in his accounts of the fertility treatments at his Temple of Hymen, but we see it even the apparatus of his Temple of Health:

In the centre of the room . . . stands a massy pedestal . . . From the top of the pedestal rise three large proportioned columns of beautifully cut and very brilliant flint glass . . . which, altogether, support an electrical prime conductor, laying horizontally and lengthwise along the room. This stupendous metallic conductor, is a cylinder ending in two semi-globes: it is no less than eleven feet long, and four feet in circumferences; and is so far elevated from the floor, that a man of six feet four inches high could walk erect under the lowest part of it.⁷⁴

This is standard electrical equipment, built on a monolithic scale. The prime conductor is used to conduct the electric charge produced by an electric machine, to be stored in a Leyden jar, where the charge can be released. Graham even specifies that the conductor is insulated by the glass material. But his account of this equipment is also clearly bawdy, anticipating his notorious caricature representation in *The Quacks*, published three years later, in which his ‘stupendous metal conductor’ is centre stage (Fig. 3.1).⁷⁵ His reference to ‘semi-globes’ also echoes the language of a new set of electrical erotica produced in the 1770s, which, like the *Teague-root display’d*, exploits the connection between the gestures of electrical experimentation and sexual acts.

The Semi-Globes (1777) is a poem that celebrates the electric attraction of women’s breasts, and that seems to anticipate some of Graham’s later electric therapies in its conclusion:

The breast that *nurtures*, shall for ever *charm*.
 Propitious VENUS, goddess of desire!
 Inspire thy vot’ries with a gentle fire
 That *warms*, not *burns*; *enlivens*, not *destroys*.⁷⁶

Here electricity is gentle and vitalising, precisely the aspects that Graham emphasises in his treatments. In more scurrilous mode, several poems produced in the late 1770s play on the connection between male and female genitalia and the electric fish recently discovered, the *gymnotus electricus*, or electric eel, and the torpedo. *The Torpedo* (1777) makes the

One case that holds an important status for Graham is that of Pivati and his electrified herbal therapies. Though Graham does not mention Pivati by name, many of his treatments seem indebted to his work. Like Pivati, Graham uses electricity both as a catalyst of the salutary properties of medicine, and as a medium to convey medicinal substances to the bodies of his patients. In the *General State* he advocates the use of medicines with the ‘assistance of electricity’, and in *The Guardian Goddess of Health, or, the Whole Art of Preventing and Curing Diseases* (1780), he develops this principle, describing his treatment as:

a combination, or concentration of all [nature’s] elementary powers, and vivifying influences: being an essence extracted by air, magnetism, and the electrical celestial fire, from the richest oriental aromatics, &c. with the balmiest and most active aether. A few of the richest, mildest, and most cordial roots, barks, feeds, flowers, fruits, gums and basalms . . . are under my own immediate inspection selected, properly prepared, and put into massy glass vessels, and upon them is poured a due quantity of the finest aetherial spirit. They are then placed in one of the great metallic globes on the dome of the electrical Temples of Health and of Hymen . . . to be acted upon by the celestial fire, &c.⁷⁸

Graham’s electrical aether is a compound of herbal treatments, ‘acted upon’ by electricity in the spectacular setting of the Temple of Health. In the *Sketch*, he demonstrates how he has developed Pivati’s practice, describing how these medicines are conveyed to the patient. Again the setting is vital: the Temple functions not just as a laboratory but also as a treatment theatre, which, in Graham’s words, ‘breathes health’:

For . . . so great a stream of the electrical or elementary fire is brought in, that the patient, when the Apollo chamber is darkened, appears enthroned and environed with a visible species of celestial glory! – Add to this, that the patient so far from receiving any shock, is exhilarated and delighted with the aromatic aetherial odours, while he cleanses his lungs, purifies and circulates his blood, and fortifies his nerves by breathing the electrical, dephlogisticated and vivifying atmosphere with which he is surrounded.⁷⁹

Graham’s focus on the ‘dephlogisticated and vivifying atmosphere’ of his temple reveals that his medical treatments are not just indebted to Pivati, but also to a more recent, and reputable, strand of natural philosophy. Graham’s language echoes that of Priestley, in particular his *Experiments*

and Observations on Different Kinds of Air (1774–1777), which describes the isolation of certain gases and speculates about their medical application. Graham's repeated references to the benefits of the 'various kinds of factitious air' in his Temples suggest Priestley's enduring influence.⁸⁰ But though he exploits Priestley's recent achievements, Graham nowhere displays any kind of anxiety about the proximity of his medical treatments to discredited work of a generation earlier.

Graham departs from the practice of Pivati, however, when he attempts to explain the causes of his treatments. He offers four related explanations for their efficacy. First, Graham's 'electrical aether' is 'vivifying'; it has an inherent connection with the life force of humans, animals and even plants.⁸¹ Graham seems to gesture to a similar tradition to Stukeley and supporters of an aethereal model of electricity, in which a universal electric power animates the world, and he draws more explicitly on this tradition in his writings on generation. Second, electricity removes 'obstructions' in the body's internal fluids. In the *Guardian Goddess*, Graham's treatments 'promote all the natural and necessary circulations, secretions and absorptions'.⁸² Graham is not the first to make this claim; Nollet for instance, declared that 'electrification accelerated and enlivened fluid motion'.⁸³ Third, Graham implies that electricity might be inherent in the body, as a principle of the nerves, another suggestion which ties his work to that of Stukeley, but also to more recent theorists like Priestley. In the *Short Extract*, he advocates 'rubbing and exercise' to 'excite the animal electricity',⁸⁴ and later describes 'particles of odorous or luminous matter' which emanate from every human body, and 'are, what may very properly be called ANIMAL ELECTRICITY! or a species of magnetico-electrical effluvium'.⁸⁵ In naming 'animal electricity' as an integral aspect of the living body, Graham coins one of the earliest uses of a term which by the 1790s was to become ubiquitous as I discuss in [Chapter 4](#).⁸⁶ Though Graham does not define animal electricity, his work again chimes with contemporary electrical practices.

But it is his last, and most provocative suggestion, which ties Graham's work most closely to the discourses of electrical erotica. Graham suggests that his electrical cures might be entirely an effect of the imagination. In the *General State*, he records his initial confusion at reports by patients who had been turned away from the Temple of Health without treatment, that they had been cured.

At first, I considered these reports as untrue and nonsensical; or at most, as proofs of the astonishing power of the imagination; till, reflecting on the

matter, I am now of opinion, that there may be some just foundation for them. For what may not the divinely harmonious musical modulations and influences – with a lively imagination, perform? – Or, is it surprising that, spasmodic irritations – nervous weaknesses and relaxations . . . should give way to the above, especially when joined to the important circumstance of breathing for hours an atmosphere highly and richly charged with electric and aethereal principles?⁸⁷

Graham does not quite declare these cures solely the result of his patients' susceptibility to a placebo; he ascribes them to the power of the imagination in conjunction with the 'electric and aethereal principles' which fill his Temple of Health. But importantly, he does not distinguish between this diffused medicine, and the operation of imagination. Rather, the two work in tandem. Graham is not alone in making this suggestion; Nollet and the mesmerism commissioners reach for the same conclusion.⁸⁸ But unlike those commentators Graham seems remarkably unruffled by the need to acknowledge that his cures are partly imaginary.

The imagination in no way invalidates Graham's practice. He remarks frequently on the way in which his electrical treatments exceed the observation of the senses, thus requiring a turn to imaginative hypothesis.

What need is there to expatiate on the genial qualities of the sun, which are universally felt, and universally acknowledged? – I will only observe for the information of the world in general, that . . . [my cures induce] that happy *equilibrium* – that peaceful balance! which nature delights in.⁸⁹

Graham's emphasis on balance hints at his familiarity with his Edinburgh contemporary John Brown's system of medicine, in which the body must be brought into equilibrium.⁹⁰ But more broadly, his account of the limits of his knowledge is consistent with those of Stukeley and other researchers in electricity. Graham admits he needs to ascend to 'the regions of metaphor' to describe the operations of his treatments, echoing Franklin's declaration that 'I feel a want of terms' when writing on electricity.⁹¹ For Graham, like Franklin, this admission of ignorance does not suggest any loss of authority. Imaginative speculation and metaphorical connections are integral aspects of his electrical research.

The mysterious operations of electricity have another advantage for Graham, as they add to the spectacle of his therapeutic practice, and encourage his patients to engage imaginatively with that spectacle. In 1780 he publishes

the text of a ‘magnificent Ode’, performed ‘at the solemn Dedication of the TEMPLE OF HEALTH’. The Ode’s chorus, sung to coincide with the appearance of ‘*many Thousands of Electrical Stars, and Meteors of Celestial Brilliance*’, celebrates ‘thou, celestial Fire! – Thou, FIRE, ELECTRIC! – GREAT RENOVATOR! – THE LIFE OF ALL THINGS!’ But the most important qualities of the ‘electric fire’ are its spectacular and obscure operations, its ‘Majesty and Mystery combin’d! / Enthron’d – unveil’d – in this tremendous, – this most genial Temple!’⁹² Graham’s astute choreography, his marshalling of ‘Majesty and Mystery combin’d’, in the spectacular arena of the Temple of Health blurs the distinction between electricity as a material force acting on the bodies of spectators and patients, and as a suggestive stimulus of their imaginations. As Otto has noted, Graham demonstrates a ‘canny . . . awareness that . . . fantasy was already a “quasi-material” force, able to exert a shaping influence on the real’.⁹³ In all Graham’s explanations of the operation of his electrical cures, from the electrical vital spirit to animal electricity, to the removal of bodily obstructions or the influence of the imagination, he shows a remarkable openness to the material influence of ‘fantasy’.

Graham’s stage-managing of the performance of his Ode, and his claim that the Apollo apartment is a space which ‘breathes health’, suggest that the Temple of Health is designed as an immersive experience; just breathing the air of the Temple can effect a miraculous cure.⁹⁴ But, as Otto suggests, the rhetorical power of Graham’s claims for his treatments arises not only from the superb surroundings of the Temple, but also from the suggestion that its ‘aetherial electrical’ forces are connected with the infinite powers which move the universe. Graham repeatedly claims a continuum between these universal powers and his treatments, thus drawing on the discourse of the *anima mundi*. In his *Sketch* he notes that his patients’ ailments fall away at ‘the wonderful influences of these secret yet irresistible agents’, the electrical forces which their bodies possess ‘in common with everything else in the universe’.⁹⁵ And in his description of the Apollo apartment in the Temple of Health, Graham even declares ‘electricity or the elementary fire, air, and magnetism’,

three of the greatest of those agents or universal principles, which pervading all created beings and substances that we are acquainted with, connect, animate, and keep together all nature! . . . principles which constitute as it were the various faculties of the material soul of the universe: – the ETERNALLY SUPREME JEHOVAH himself! Being the essential source – the Life of that life – the Agent in those agents – the Soul of that soul – the all-creating – all-

sustaining – all-blessing GOD! . . . The King of Kings! The Lord of Lords! The God of Gods! – the Soul of all Souls! – the LIGHT of all Light; – The – !!! but here, here at the entrance of intellectual vision – on that very threshold of comprehension we stop, – shrinking before THAT INCOMPREHENSIBLE MAJESTY – or light – or essence – or somewhat!⁹⁶

Graham's praise of these 'universal principles' shifts into a praise of the divine power. This is not mere rhetoric; Otto notes the ways in which his genuine Christian faith informs his practice.⁹⁷ But Graham's description of these aetherial electrical powers as 'the material soul of the universe', a mystical power which can nonetheless effect material cures, moves his claim into a different register, recalling the discussions of anima and aether I discuss in [Chapter 2](#). As Otto notes, 'The force deployed in [Graham's] therapies was . . . indifferently spiritual *and* material: he seems to spiritualise material forces, while at the same time troping as material what had previously been considered purely spiritual powers.'⁹⁸ Graham is far from alone in claiming electricity to be 'the *anima mundi*, or material soul of the universe', but he is unusual in developing a definition of the *anima mundi*.⁹⁹ In his footnote to another claim for electricity as the 'material soul of the universe!' in the *Guardian Goddess of Health*, Graham declares that he has no interest in theological debate:

I find that the materiality or nature of the soul is *now* a point bitterly disputed by philosophers. For my own part, I profess that I know nothing at all about the matter . . . As to *this*, and all other matters which ARE NOT ESSENTIAL to our happiness . . . and which *cannot possibly be settled* in this world – I think we had better be easy, than to quarrel – wrangle –and disturb one another about such abstruse, metaphysical, and I may say nonsensical matters.¹⁰⁰

Ever the pragmatist, Graham prefers to focus on the effects of these powers, rather than speculate about their causes. In a rare hint of his philosophical position, Graham implies that in the same way as light, electricity (and by extension the soul) 'though supremely pure, and infinitely subtil – is nevertheless material', thus aligning himself with the materialist thought of Priestley and later radicals like John Thelwall.¹⁰¹ But rather than dwell on such niceties, Graham emphasises the splendour of these forces, because he intuits that such cures are effected by capturing the imagination of his subjects.

Graham's interest in and celebration of the imagination finds its most sustained expression in his sex therapies. Despite the odd bawdy hint,

Graham does not make sex the focus of his therapeutic work until the second half of his medical career. This turn to the sexological coincides with an increased focus on display: as Syson notes, after 1780 ‘Graham no longer even tried to promote the temple as a sanctuary of science, or a medical museum, but as an unabashedly commercial venture.’¹⁰² In 1783 Graham produces a new edition of his 1780 *Lecture on Generation*. In contrast to the predominantly academic tone of the 1780 text, in 1783 he apologises for ‘dry philosophical part of our discourse’, and concludes ‘with the richest, – the merriest, – the most useful, and most interesting part of the subject... the very highly and justly celebrated Celestial-bed!’¹⁰³ But despite this change in emphasis, there are important continuities in Graham’s therapeutic practice and in his theorization of the ‘aetherial electric’ spirit. Even when applied to the promotion of fertility and sexual pleasure, electricity is a healing tool, whether it operates on the imagination or body of its subject, or both.

Graham’s writings on generation are consistent with his account of health in general. In the *Short Inquiry* of 1776, he had declared his treatments effective because ‘these aetherial, vivifying medicines refresh, restore, and reanimate’,¹⁰⁴ and in an advertisement for the fertility treatments at the Temple of Hymen, Graham declares that

electricity... gives a tone and retentive firmness to the relaxed fibres – it corrects the acrimony of the juices... strengthens and rejuvenates the generative powers, and effectually removes obstructions. It expels all fear, expanding the imagination with the liveliest and most sublime ideas... and from all these causes cannot fail of producing the wished for effects.¹⁰⁵

In cases of infertility too, Graham’s treatments vivify, remove obstructions, and act on the patient’s imagination. His 1783 *Lecture* repeats two case histories from the 1780 text, both of which make the case for the connection between electricity, fertility and sexual pleasure. In the first, Graham describes the moment he realised electricity’s importance for fertility:

Wonderful... are the effects of holding venereal congress in situations where the passions are very highly excited, or where the hopes of progeny are very strongly impressed on the mind. To these strong mental impressions I formally attributed, in some measure, the unexpected conceptions which took place in the infancy of my celestial bed!¹⁰⁶

Like the cures of the Temple of Health, Graham suggests, the electrical bed acts by stimulating the imagination. He describes the first prototype of this ‘*then whimsical*’ electrical bed, and notes the fun had by ‘several of my medical, philosophical and gay friends’, but its status moves from sex toy to therapeutic tool when Graham describes its success in the treatment of ‘a good, stout like Dutch woman’ troubled by a ‘paralytic complaint’ and ‘total menstrual obstruction’.¹⁰⁷ Graham prescribed the electric bed with ‘no other intention’ than to cure her physical ills, but in six weeks, ‘by sleeping, as usual, in the electrical bed [with her husband], she returned home in perfect health and high spirits, and happily pregnant’.¹⁰⁸ He does not offer an explanation for her cure but, immediately after this case study, launches into an account of ‘the influence of the imagination in affairs of love’, again suggesting a connection between electricity and fantasy.¹⁰⁹

The second case contains more circumstantial and therapeutic details. Though Graham does not name his patient, he drops several hints that the lady, ‘blessed with a fine understanding, with much resolution, and at the same time, of exemplary and unspotted virtue and delicacy’ is Georgiana Cavendish, Duchess of Devonshire. She is ‘electrified for an hour or two daily, under aethereal and magnetic influences’, and bathes. Graham cites her testimony ‘that it was chiefly to the showers of aether and electricity, pervading the spine, &c. and to the topical application of the bracing icy cold spa-water’ that she owed her pregnancy, but can’t resist nodding to electricity’s erotic associations by adding that it was ‘assisted no doubt by an electrical touch or two from her husband’.¹¹⁰ In these cases, electricity is one of a range of therapeutic practices both bodily and mental. Graham does not yet make detailed claims for the connection between electricity and conception, and the operations of his celestial bed.

Graham takes time to work up to the most extravagant claims for the potency of his celestial bed. In his *Sketch* of 1780, the lavish descriptions of his Temple and its health treatments are in contrast with his concise account of the bed, and in his *Lecture on Generation* of the same year, he discusses both the mechanics and the pleasures of sex, but does not seem to have found a way to connect the sexual act with the operations of electricity, beyond his suggestion that the imagination is important for both.¹¹¹ This changes with the publication in 1782 of *Il Convito Amoroso! Or, a serio-comical-philosophical lecture on the causes, nature and effects of love and beauty at the different periods of human life*. Though delivered by the goddess ‘Hebe Vestina’ this ‘serio-comical-philosophical’ lecture is Graham’s work, which promotes a new theory of electricity and sex. In *Il Convito*, Hebe Vestina

gives her account of the philosophy of love, and hints that electricity is central to this process. She describes ‘the grand animating principle, – the all-mighty agent! – which . . . I may call, indifferently, – the magnetico-electrical fire or effluvium, – the pabulum of pleasure, – the essence of ages, – and, the liquor of life’.¹¹² She refuses to define this ‘fire’, because ‘to analyse this wonderful principle, so as to render it demonstrable, would be as vain and impossible, as to give a fixt, specific, and intelligible definition of the passion itself to those who have never *felt it in full delirium*’.¹¹³ But in a departure from Graham’s usual procedure, she offers an explicit explanation of her ‘philosophy of love’.

Love proceeds from the ‘subtile magnetico-electrical fire or effluvium’ which surrounds and emanates from every human body:

When this subtile electrical fluid which is excited by the action of the soul or animal spirits on the bodily organs . . . strikes on the organs of sense of another person, it . . . causes a thrilling vibratory titillation in the fibres . . . This titillation causes a reflux or sweet vibratory delirium in the brain, which soothes and gives pleasure to the soul; – whereupon the soul soothed or bewitched with this pleasures, wishes for a continuance of it . . . and this, doubtless, is the origin of what we call love, or inclination.¹¹⁴

This electrical theory of love enables Graham to make an explicit connection between electricity and sex. Hebe Vestina’s account of the electrical ‘odoriferous particles, or insensible transpirations’ changes register to access an erotic discourse:

It is pretty well known how they act upon the taste; – that *suction* most powerfully attracts them; – that *kisses* dissolve them . . . that they gush from the rich pulp of the lips; – and that by the touch or collision of *certain parts*, they undulate and thrill from the *magical centre*! With electrical swiftness – with harmonious vibrations! – with extatic soul-dissolving delight! – thro’ every, even the most distant nerve!¹¹⁵

By connecting electricity and sex, Graham finds a new language at his disposal, namely that of the erotic satires of the 1770s which compare the gestures of electrical experimentation with sexual acts. Hebe Vestina claims the ‘analogy’ between electricity and sex, which closely echoes Stukeley’s claims:

Courtship and dalliance is no other than charging the battery on the *one* side, and heating or preparing the genial oven of nature on the *other* . . . – The

analogy holds good even to the *end of the business*; for the natural consummation, or the *final* discharge or delivery of this electrical fluid – of this *balmy benevolence!* is in all respects, a true electrical operation. Here we have . . . the necessary friction or excitation of the electrical tube or cylinder, for mustering up and accumulating the prolific fiery fluid in the Prime Conductor . . . we have the positive and the negative fire; the active and passive principles; the plus and the minus state; – in a word, there is the strictest and most cordial harmony, – the clearest and most perfect analogy in all respects.¹¹⁶

Hebe Vestina's claims echo those of smut writers, satirists and quack healers, but they also resonate with the work of electrical researchers for whom, as for Graham, the amorous glances between lovers, 'the vivid flashings of the eyes' are also electrical, and who reason by analogy.¹¹⁷ But Graham sees no need to stick to strict analogy, or to distinguish between electricity's material and metaphorical effects.

Graham returns to the claims of *Il Convito* in his own persona in the 1783 version of his *Lecture on Generation*, connecting sex and electricity in a much more explicit fashion than in the 1780 text:

Those divine, those bewitching those heart-piercing and irresistible glances, which shoot from the female eye to the male heart, and indeed reciprocally, from soul to soul . . . are no other than electrical strokes or emanations! – and I am clearly and decidedly of opinion, that even the venereal act itself . . . is in fact, no other than an electrical operation!¹¹⁸

Graham appeals to his audience as 'gentlemen who understand electrical science extremely well', and talks them through the details of the 'analogy'. First,

there is the necessary friction or excitation of the animal electrical tube or cylinder, for the accumulation, or mustering up of the balmy fire of life! – this is what electricians call the charging of the vial or jar. Then follows the discharging, or passage of that balmy, luminous, active principle, from the *plus* male to the *minus* female. These are all mere, plain, demonstrable electrical processes.¹¹⁹

Graham establishes this electrical theory of love and of sex in order to then make claims for his celestial bed. In the light of this 'philosophy' the bed appears not a charlatan's trick and but rather the material apparatus of Graham's electrical sexology.¹²⁰

It is not until the 1783 version of the *Lecture*, following Hebe Vestina's electrical theory of sexual pleasure and fertility, that we get a full and lavish account of Graham's 'GRAND CELESTIAL STATE BED!' He stresses the grand dimensions ('twelve feet long by nine wide') ornate structure ('forty pillars of brilliant glass') and beautiful finish ('sweetly delicate, and richly variegated colours, and the most brilliant polish!') of the bed, but also its rigour for the purposes of electrical experimentation. It is covered with 'transparent varnish, in order to render the insulation still more complete, and that . . . we may have, in even the most unfavourable weather, abundance of the electrical fire'.¹²¹ The 'sublime, magnificent, and . . . super-celestial dome of the bed' is laid with mirrors to reflect 'the various charms and attitudes of the happy couple', but is also designed to contain

the odoriferous, balmy and aethereal spices, odours and essences, and which is the grand magazine, or reservoir of those vivifying, and invigorating influences which are exhaled and dispersed by the breath of the music, and by the attenuating, repelling, and accelerating force of the electrical fire.¹²²

As Otto notes, Graham accentuates the sublime resonances of the celestial bed, apostrophising Prometheus in his account of the generation of new life.¹²³ But integral to the spectacle is the way in which Graham's theory, and his therapeutic practice complement, even match, the equipment and techniques of the broader discourse of electrical experimentation. Graham suggests that electrical science should acknowledge its proximity to, even its reliance on, the operation of the imagination. This is clear in his description of the bed in which electricity

warms and invigorates the whole system! – expanding the imagination, and every faculty of both body and soul! – exciting and exalting the amorous ideas of both sexes – stimulating them to the enjoyment of love; – and greatly heightening and prolonging its sweetest pleasures!¹²⁴

Again Graham's language comes close to that of the erotic works which satirise electrical experimentation. But rather than laugh at the connection between electricity, fantasy and arousal, or formulate it as a problem in the manner of the animal magnetism commissioners, Graham makes this connection a fundamental principle of his therapeutic practice and hypothetical speculations. Graham's contemporaries were, of course, not

universally persuaded by his claims. He was the target of intense critique and satire in the London theatre and in newspapers.¹²⁵ Even his patients soon deserted him, leaving him to huge debts, charges of indecency and increasingly bizarre new treatment practices, including baths of earth.¹²⁶ But the strength of the response to Graham demonstrates the degree to which his disreputable practice in fact comes extremely close to the work of respectable experimenters and healers.

3 ROBERT MERRY AND MARY ROBINSON

Another group of writers explore the connections between electricity, sexual attraction and health, and rather than merely accepting the disreputable implications of this discourse, they celebrate the emotional and even political value of such connections. They are the group of poets known collectively as the Della Cruscans, though I focus on the work of Robert Merry and Mary Robinson. Merry's and Robinson's use of electrical images does not connect electricity with sexual attraction in the manner of Stukeley, Graham and the anonymous writers of erotica. But the two poets draw on the uncertain provenance of electrical communication, and exploit the metaphorical potency of such uncertainty. They also celebrate the significance of the body in electrical experimentation, particularly the application of electricity to health treatments, and use it for their own rhetorical ends. In doing so, they draw on the earlier discourses of electricity, sex and health in order to produce new representations of the communication of feeling. Merry and Robinson exploit electricity's uncertain provenance, the way in which it is mysterious to the extent that it requires figurative language to account for its effects. They use its possibilities as an image of communication to suggest that the effects of electricity are potentially universal, and its communicative properties enable not only erotic but also salutary connections. Merry's and Robinson's uses of electrical images are thus crucial to the articulation of their affective, erotic and political worldview.

I focus on two moments in Merry's and Robinson's poetic careers in which they make important use of electrical tropes: first their erotically and emotionally charged Della Cruscan verse of the 1780s and second their political poems in support of the French Revolution from the early 1790s. In drawing continuities between Della Cruscan verse of the 1780s and the later, politically engaged work, I follow Jon Mee, who argues that Robinson's poem *Ainsi va le Monde* (1790) responded to Merry's *The Laurel of Liberty* (1790), and was an 'explicitly politicised extension of the

flirtations of Della Cruscanism'.¹²⁷ But as Harriet Guest notes, such fusing of eroticism and radical politics was a much simpler matter for Merry than for Robinson. For Guest, *Ainsi va le Monde* represents the high-water mark of Robinson's engagement with 'the delirious sensationalism and enthusiastic rapture of Merry's work', and after 1790 'Robinson's expansive notions of freedom, and admiration for the universal benevolence praised in Merry's work... are increasingly cautious and confined'.¹²⁸ There is a clear shift in Robinson's writings as Guest suggests, and there is another reason for Robinson to practise caution in all her poetic works. As Fulford has noted, Robinson's literary practice might be read as an attempt to distance herself from the scandalous traces of her youthful career as an actress and mistress to influential men, a career which saw her associated with various disreputable forms of display, in particular the spectacular charlatanism of Graham.¹²⁹ The divergence of Robinson's and Merry's careers, Guest asserts, is particularly strongly marked in the *Ode for the Fourteenth of July 1791, the day consecrated to freedom: being the anniversary of the revolution in France*, which Merry wrote to be performed at the celebratory dinner at the Crown and Anchor Tavern marking the second anniversary of the French Revolution. Robinson was indeed excluded from the 'fraternal solidarity' celebrated in Merry's *Ode*; but I suggest that there is an electrical impulsiveness common to *The Laurel of Liberty*, *Ainsi va le Monde* and *Ode for the Fourteenth of July*, which is crucial to the poetic and political claims of both poets.¹³⁰ It allows Robinson to continue to celebrate the positive effects of the disreputable communication practised by Graham, and enables Merry in turn to sustain a commitment to a radically inclusive form of sociability, even in a tavern drinking song.

During the 1770s and 1780s, Robinson was mistress first of George, Prince of Wales, and then, allegedly, of Charles James Fox, the Whig leader. In 1780 her notoriety seemed sealed when she was reported to have attended Graham's Temple of Health and Hymen. In his satirical poem *The Celestial Beds* (1781) William Mason identifies Robinson, or 'sweet Perdita', her stage name, among the votaries of Graham's Temple, the 'debauchees [who] / Thither haste with knocking knees'.¹³¹ Perdita seeks Graham's help to renew the affections of the Prince of Wales by becoming pregnant:

shall not she, his joy and pride,
Be for a pledge electrify'd?
Yes, Graham shall exert his art,

And give a bantling to her heart!
 The Muses darling it shall be,
 The flow'r of royal progeny!¹³²

The real target of Mason's satire is Graham, the 'imperial Quack' who claims that his 'gilded metaphoric pills / Can cure disease of all its ills'.¹³³ But by making the association between Graham's disreputable medicine and the fashionable 'slaves of *bon ton*', represented by Robinson, the poem argues that both operate through the exploitation of spectacle and the coercion of the susceptible imaginations of the credulous. Robinson thus seems to have great cause for distancing herself from this past.

Robinson's reputation suffered as a result of her public association with Graham, and as Fulford notes, she seems to get her revenge in her 1797 novel *Walsingham, or the Pupil of Nature*.¹³⁴ The novel includes a satirical portrait of Graham in the figure of Doctor Pimpernel, who objectifies young women while claiming that 'the sublime essence of [their] odiferous breath will [cure any disease]... Nothing like the balsamic smile of a beautiful woman!', and who urges the hero to 'read my voluminous work – my world of information – my Barley-water panacea – my immortal recipe for degenerated humanity!'.¹³⁵ Pimpernel is an obvious caricature of Graham, but it is interesting to note what Robinson chooses not to satirise. Though she makes Pimpernel a quack, she never critiques Graham's electrical therapies. Robinson seems to see something enabling in Graham's use of electricity, and she makes complex and effective use of it in her poetic works. Robinson's appropriation of electrical images in her poetry exploits the very aspects of electrical science that make Graham's work appear beyond the pale, namely the centrality of the body in electrical experimentation, and electricity's association with both sex and health. Robinson does not completely leave her past behind, because she understands the significance of Graham's claims, which she uses in her own work. Robinson draws on Graham's model of electrical health and electrical pleasure to describe emotional and political communication, and articulate a model of human progress and liberty.

Before they turned to explicitly political verse in the 1790s, Merry and Robinson produced what are now known as Della Cruscan poetic works in the 1780s. Following Jerome McGann's intervention in *The Poetics of Sensibility* Della Cruscan verse has increasingly been the subject of critical discussion.¹³⁶ Angela Esterhammer characterises Della Cruscan poetry as 'sentimental, sociable, semi-erotic, overcharged, and theatrical', but it also has political and scientific significance.¹³⁷ It demonstrates what Noel Jackson

identifies as a quality of Romantic poetry in general, ‘an understanding of sensation as a crucial resource of cultural representation and a vital conduit for imagining models of political consciousness, communicative ethics, and social change’.¹³⁸ Della Crusca verse, since its first appearance in the *Florence Miscellany* and then *The World* newspaper in 1786, articulated a version of Jackson’s ‘communicative ethics’ through its celebration of unlimited communication, both social and sexual, and of material manifestations of emotional states. Even in its earliest forms, this celebration is informed by models of electrical communication and their erotic associations. Such language characterises the poetic exchanges between Merry, writing as Della Crusca, and Hannah Cowley, or Anna Matilda. In Della Crusca’s poem ‘To Anna Matilda’, published in *The World* on 5 December 1787, Della Crusca writes of the vivifying properties of Anna Matilda’s words:

What tho’ grim Winter’s desolating frown,
The wild waves uproar when rough Eurus blows,
The tangled forest, and the desert down,
Be all the solace DELLA CRUSCA knows:

Yet from MATILDA’s pure celestial fire,
One ruby spark shall to his gloom be given,
Lur’d by its light, his fancy may aspire,
And catch a ray of bliss—a glimpse of Heaven.¹³⁹

In this poem merely the thought of Anna Matilda has a warming, vitalizing effect on Della Crusca’s imagination. Merry does not use a language of electricity, but his reference to the ‘celestial fire’ and ‘ruby spark’ which animate his ‘fancy’ foreshadow more explicit references in his later works. Though in ‘To Anna Matilda’, the ruby spark enables a purely imaginative connection, the ‘bliss’ of their mutual exchange, just like electricity, is felt as an almost physical sensation.

Cowley takes up and intensifies this expression in a later poem from Anna Matilda ‘To Della Crusca’ (26 February 1789). Here the ‘bliss’ of the poets’ exchange is threatened by the entrance of Laura (Mary Robinson) into their circle of correspondence, and by Anna Matilda’s consequent fears for Della Crusca’s fidelity. She declares:

Whilst I danced gaily in the round
Of Folly, on her fairy ground;

And play'd, and sung, and laugh'd away
 The feath'ry hours of Life's short day,
 Thy INVOCATION, like the flame
 Which starts from the Electric frame,
 Struck on my heart! I sigh'd, I turn'd,
 And ANNA yet for DELLA CRUSCA mourn'd.
 When wounded PRIDE suffus'd its blush,
 And o'er my nerves its tremors rush.¹⁴⁰

As in Merry's poem, the verse of the poetic correspondent produces an emotional response which is felt as physical sensation, here almost against Anna Matilda's will. But by explicitly comparing this feeling to electricity, Cowley evokes a set of related associations which suggest familiarity with contemporary electrical practice. Like the electric fluid, Della Crusca's 'invocation' produces an instantaneous, nervous sensation, its 'tremors' suggesting an erotic element to the emotional response.

The electric quality of the connection between Della Crusca and Anna Matilda is apparently clear to their poetic correspondents. Robinson enters the discussion in her poem 'To Anna Matilda' of 6 March 1789. Here Laura reassures Anna Matilda of Della Crusca's affections, but she again describes the effects both of her feelings and of the verse as electrical:

O Anna, since thy graceful song
 Can wind the cadence soft among
 The heart's fine nerves, and ravish thence
 The wond'ring Poet's captive sense;
 'Till warm'd by thy electric fire,
 His yielding soul, with fond desire,
 Glows but for thee—¹⁴¹

The language of electricity proves useful to these poets because they, like Graham, suggest that it is poised between the material and the immaterial, and thus provides a vocabulary for the felt emotions and sensations that the poetry strives to evoke. Such imagery is also vital to the qualities of Merry's verse emphasised by Mee, who notes that it 'appears willing to risk self-annihilation in its imagining of its relations with the world. The perceiving consciousness is not a fixed viewing position but constituted and indeed reinvented out of its reciprocal relationship with a fluxile universe.'¹⁴² Such deliberately unstable and open conceptions of selfhood are a distinctive feature not just of Merry's

poetry but of Della Cruscanism more broadly. And while Mee connects this account of selfhood to associationist models of self, it suggests also the human figure at the heart of electrical experiments, at once perceiving subject and receiving object.¹⁴³ Electricity's communicable, proliferative qualities are also important for Della Cruscan poets' conception of their own practice.¹⁴⁴ Each poem describes the electrical imperative of the verse, which produces a poetic response. This chimes with McGann's account of such poetry, in which 'the erotic and dialectical character of the writing...explicitly encouraged further writing, whether response or elaboration'.¹⁴⁵ Electrical imagery thus seems an emblem of the characteristics of Della Cruscan poetry itself: this is a sensory and sensational, communicable poetic phenomenon, which undoes stable notions of self, and which is transmitted through the newspaper press. Della Cruscanism's association with electricity is thus rooted in but ranges beyond electricity's use in erotic writings. In the hands of these poets, electricity becomes an emblem of the communication of feeling and vitality. Such gestures to universal communication strain against the strict rhyming couplets of Merry's and Robinson's Della Cruscan verse, but they suggest that the electrical energies they evoke are unrestricted by formal or physical boundaries.

Della Cruscan celebration of electrical proliferation alters after 1789, when Merry's and Robinson's writings engage explicitly with revolutionary fellow feeling. Merry's *The Laurel of Liberty*, Robinson's *Ainsi va le Monde* and Merry's *Ode for the Fourteenth of July* are replete with nervous thrills, and sparks; as Mee notes, they are consistent in practice with earlier Della Cruscan verse, but the French Revolution is a 'turning point' for the subject matter of this verse, and the audience to which it is addressed.¹⁴⁶ And though it was more difficult for Robinson than for Merry to continue to support revolutionary sociability in her poetry, the language of electricity gives Robinson a means to articulate her political faith, and gives Merry a language to signal his continued debt to her. In their political poetry of the 1790s, for the first time, we see Merry and Robinson evoke not only the vital, thrilling and erotic, but also the health-giving properties of electricity. It is this quality in particular which allows the poets to argue for the positive effects of revolutionary fellow feeling.

Merry's preface to the *Laurel of Liberty* figures the poem itself as part of a tide of anti-government opinion flowing throughout Europe: 'the progress of Opinion' Merry declares, 'is a rapid stream, though it may be checked, it

cannot be controuled'.¹⁴⁷ The opening lines build upon this image of a 'stream' of opinion, suggesting that Merry has in mind an immaterial fluid:

Genius or Muse, what'er though art! Whose thrill
Exalts the fancy, and inflames the will,
Bids o'er the heart sublime sensation roll
And wakes exstatic fervour in the soul.¹⁴⁸

The 'thrill' of the muse animates the listener, infusing him with ardent thoughts and energies in a similar fashion to Anna Matilda's verse:

With smiles benign thy ardent vot'ry hear,
Hang o'er his eyes thy gossamer tear,
Wake the true throb, the living flame impart,
Usurp his mind, and seize upon his heart.¹⁴⁹

It soon becomes apparent that the vital energies of this quasi-electrical 'living flame' are stimulated not by erotic feeling but by political fervour. In the middle section of the poem Liberty produces a long speech in which she declares

So shall my meliorating mercy run
To light the world, a sublunary Sun;
Till Education, Legislation join
To energize the soul, and to refine,¹⁵⁰

Liberty's 'meliorating' influence also runs like a stream, and its effects are enlightening and vitalizing. As the poem progresses it becomes clear that Merry is engaging with a discourse of vitality in which the human body is possessed of a latent life force, which might be galvanised by an external spark. This discourse gains traction over the course of the 1790s and into the nineteenth century, as I discuss in [Chapters 4 and 5](#). And importantly for Merry's political case, the spark aroused in the listener can then proliferate, diffusing this political spirit still further:

Yet shall my song all feeble tho' it be,
Awake the latent spark of energy;
And shew, in Nature's universal scale,
That each with each must equally prevail,¹⁵¹

Merry characterises the poem itself as the catalyst of a quasi-electrical process of reciprocal political communication. The final section, an account of current events in France, suggests that such communication of the ‘latent spark’ is already taking place there: ‘Behold! How swift thro’ ev’ry vital part, / Shoots the fine flame that animates the heart’.¹⁵² For Merry the ‘spark of energy’ awakened by Liberty can be communicated, through the ‘stream’ of opinion of which the poem forms a part, to the nation at large; and the logic of his model of quasi-electrical energy suggests that there is no limit to such proliferation.¹⁵³

Robinson’s *Ainsi va le Monde*, which she declared was written twelve hours after receiving Merry’s *Laurel of Liberty*, seems to be a politicised version of the call and responses of the Della Cruscan. But Robinson also develops and extends the figurative register of Merry’s verse, making a more explicit case for electricity as a symbol of revolutionary fellow feeling, and developing a sophisticated account of this electric force as both erotic and salutary. In doing so, she builds on the lessons she may have learned from James Graham. As in Robinson’s earlier verse, Merry’s work is praised for its proliferative effects: ‘emulation kindles fancy’s fire, / The glorious throng poetic flights inspire’; and in an apparent misquotation from the *Laurel of Liberty*, Robinson connects this fire with the ‘latent spark’ of revolutionary energy that Merry perceives in every individual: ‘So shall thy song to glorious themes aspire, / “Warm’d with a spark” of his transcendent fire’.¹⁵⁴ The poem moves to an explicit discussion of freedom in strikingly similar terms to Merry, and Robinson seems to enact the fiery inspiration she has described:

Thro’ all the scenes of Nature’s varying plan,
 Celestial Freedom warms the breast of man;
 Led by her daring hand, what pow’r can bind
 The boundless efforts of the lab’ring mind.
 The god-like fervour, thrilling thro’ the heart,
 Gives new creation to each vital part;
 Throbs rapture thro’ each palpitating vein,
 Wings the rapt thought, and warms the fertile brain.¹⁵⁵

As in the *Laurel of Liberty*, the Della Cruscan ‘thrillings’ and warmth inspired by the goddess Freedom seem both the subject and the catalyst of this verse, but they have their source in political fervour not in erotic desire. Like electricity this ‘fervour’ has vital properties, creating new life, energies and ‘rapt thought’.

But in a departure from Merry's poem, Robinson shifts her focus from the vital, animating properties of this 'fervour' to its effects on the health of the nation. In an account of Liberty, the poem asks

Who that has tasted bliss will e'er deny
 The magic power of thrilling extacy?
 Who that has breath'd Health's vivifying breeze,
 Would tempt the dire contagion of Disease?¹⁵⁶

Robinson seems to acknowledge that not all forms of communicative contagion operate in service of liberty; they also bring corruption and disease. But this statement does not contradict the celebrations of revolutionary communication that precede and follow it. Rather, Robinson's reference to the 'vivifying breeze' of health seems to gesture to a canon of electrical therapies, in particular those of Graham. This allows her to move from the language of sparks and thrills which evoke but do not name electrical communication, to an explicit celebration of electricity's therapeutic effects in the concluding lines of the poem:

Freedom—blithe Goddess of the rainbow vest,
 In dimpled smiles and radiant beauties drest,
 I court thee from thy azure-spangled bed
 Where Ether floats about thy winged head;
 Where tip-toe pleasure swells the choral song,
 While gales of odour waft the Cherub throng...
 The tuneful sisters prompt the heavenly choir,
 Thy temple glitters with Promethean fire.
 The sacred Priestess in the centre stands,
 She strews the sapphire floor with flow'ry bands.
 See! From her shrine electric incense rise;
 Hark! 'Freedom' echoes thro' the vaulted skies.
 The Goddess speaks! O mark the blest decree,—
 TYRANTS SHALL FALL—TRIUMPHANT MAN BE FREE!¹⁵⁷

Robinson's opening address to Freedom echoes Merry's *Laurel of Liberty* in its breathless, sensuous appeal to the goddess in her bed, and the 'wafting' of ecstatic, quasi-electrical energies around Freedom's temple evokes Della Cruscan nervous sparks and thrillings. But the setting of this scene also recalls Graham's Temple of Health, and this is

no satire, but rather a direct appropriation of Graham's language and practice, in praise of revolutionary feeling.

In these closing lines Robinson names an electrical communication for the first time in the poem, in the proliferation of Freedom's 'electric incense'. This reference intensifies the other images of smell in the passage, 'the gales of odour' and 'flowery bands'. The salutary odours call to mind Pivati's medicated tubes, and also, more powerfully 'the aromatic aetherial odours' of Graham's Temple in which 'from the great altar, and from the censers, cases, &c. containing balsamic, aromatic, and aetherial quintessences, &c. are communicated to those who sit on the throne'.¹⁵⁸ This passage seems a response to Robinson's earlier call for the nation to heal itself. Freedom's electrical energies are not only erotic, but also health-giving; like Graham's Temple, the Temple of Freedom conjured by Robinson 'breathes health'. And like Graham, Robinson takes full advantage of the range of associations of electrical communication. Freedom's electrical incense does not merely promote health; it is also 'Promethean fire', which gives life, and also enables the fall of tyrants in the poem's concluding line. Robinson astutely manages the different associations of electrical communication, acknowledging its potentially violent power but habilitating that power within an image of salutary, restorative freedom. What makes Robinson's use of such language stand apart from even Merry's is her connection of electricity not only with revolutionary communication and feeling, but also with revolutionary health. She is able to make these claims by drawing on Graham's practice of a decade earlier. Like Graham himself, she is undeterred by the disreputable associations of electrical practice because these are outweighed by the imaginative possibilities of the language of electricity. Its resistance to categorization matches the potentially limitless reach of revolutionary energies. Robinson's readers certainly seem to have recognized the rhetorical power of such imagery. The London Corresponding Society extract the final lines of the poem in their *Moral and Political Magazine* of 1796, and note in their advertisement for the *Magazine* that the 'spark of Liberty, though latent, is not extinguished, it may yet be fanned into a flame'.¹⁵⁹

Merry's *Ode for the Fourteenth of July* is a very different kind of poem to *Ainsi va le Monde*. Many aspects of the poem are tailored to the conditions of its first performance in the Crown and Anchor in July 1791. Guest observes that Merry's poetry of this period 'celebrates a politics that is both homosocial and potentially egalitarian', while for Mee, the *Ode*

represents ‘the apotheosis of this phase of [Merry’s] radical sociability’, and in illustration, both cite its chorus, which was to be repeated rousingly at the end of each verse.¹⁶⁰

*Fill high the animating glass,
And let the electric ruby pass
From hand to hand, from soul to soul;
Who shall the energy control,
Exalted, pure, refin’d,
The Health of Humankind!*¹⁶¹

Like Robinson in *Ainsi va le Monde*, Merry celebrates revolutionary freedom using a language of electrical communication.¹⁶² The conditions of the poem’s first appearance on the eve of the Priestley riots in Birmingham, not to mention Merry’s provocative references in the *Ode* to the ‘Oppressor’s Rod’, and the ‘Swinish Multitude’, ensure that the poem carries a different order of radical challenge to the status quo than we find in *The Laurel of Liberty* and *Ainsi va le Monde*. But the continuities between Merry’s and Robinson’s work provide a clue to Merry’s willingness in the *Ode* to dally with such incendiary images of revolutionary communication.

The chorus of Merry’s *Ode* echoes Robinson’s celebration of Freedom’s Temple in the close to *Ainsi va le Monde*, and it is Robinson’s influence that allows Merry to evoke the positive associations of electrical communication. Essentially Merry’s chorus is a celebration and a description of a toast, a drinking song. The ‘animating glass’, filled with ‘ruby’ claret, is to be passed from hand to hand as the company drinks to ‘the health of humankind’.¹⁶³ But the chorus is also a celebration and a description of a very different order of communication. Merry’s language gestures to that of electrical experiments, and by evoking electricity, his verse refers to the succession of inter-related communicative practices that I have discussed. Merry’s ‘animating glass’ describes the glass tubes of electrical experimentation, and evokes the excitement prompted by the spectacular effects of these experiments, but also suggests the ‘animating’ properties of vital electricity, which has been such an important thread of his poetry since the 1780s. The image of the ‘electric ruby’ echoes the ‘sapphire floor’ of Freedom’s Temple at the close of *Ainsi va le Monde*. But it also evokes Della Crusca’s poem to Anna Matilda 1787: ‘from MATILDA’s pure celestial fire, / One ruby spark shall to his gloom be given’, in which the quasi-electrical energies stand for imaginative and erotic

connection at a distance. In the *Ode* as in Merry's earlier poem, the 'electric ruby' seems a symbol of the vitalising communicative power of poetry, and a shared revolutionary fellow feeling which knows no borders.

The proliferative, potentially uncontrollable qualities of electrical communication are a feature of the succeeding lines, in which the electric force passes 'from hand to hand, from soul to soul', and Merry himself raises the issue of control in the line which could be a statement or could be a question: 'Who shall the energy control?'. But just at the moment when the energies celebrated in this chorus threaten to devolve into riot, Merry stresses the salutary properties of this electrical energy, which will ensure 'the Health of Humankind'. Merry pays tribute to Robinson by evoking her image of electrical political health. This is by no means a straightforward tribute, as in doing so he also evokes the heterodox, impolite culture of electrical treatments such as Graham's, which objectified female participants while celebrating, even fetishising women's sexuality. Yet by evoking the culture of electrical medicine, Merry introduces the possibility of female participation in political culture. And in addition, Merry insists that contagious, riotous electrical communication can be imagined not as a pernicious plague or force of licentious attraction, but as a vitalising, salutary political animating spirit.

NOTES

1. Schaffer 'Self Evidence', 339–340; Bertucci, 'Therapeutic Attractions', 276–277; Rowbottom and Susskind, *Electricity and Medicine*, 15–30.
2. Delbourgo, *A Most Amazing Scene*, 4.
3. Schaffer 'Self Evidence', 329–330.
4. Cleland, *Fanny Hill*, 211; see also Delbourgo, *A Most Amazing Scene*, 117.
5. Delbourgo, *A Most Amazing Scene*, 25.
6. *Ibid.* See also Riskin, *Science in the Age of Sensibility*, 14.
7. Delbourgo, *A Most Amazing Scene*, 90.
8. 'An historical account of the wonderful discoveries', 194; Harvey, *Reading Sex*, 22, 87.
9. Harvey, *Reading Sex*, 87.
10. *Teague-root display'd*, 323.
11. *Ibid.*, 334–335.
12. Kinnersley, Advertisement, *Pennsylvania Gazette*, 18 April 1751.
13. Harvey, *Reading Sex*, 20.
14. Bodleian Library MSS. Eng. Misc. e.129, 8–9.

15. Stukeley, 'On the Causes of Earthquakes'; 'The Philosophy of Earthquakes'.
16. Bodleian Library MSS. Eng. Misc. e.129, 64–66. See also Stukeley, 'On the Causes of Earthquakes', 645.
17. Stukeley, 'The Philosophy of Earthquakes', 747.
18. Bodleian Library MSS. Eng. Misc. e.129, 31.
19. Stukeley, 'The Philosophy of Earthquakes', 748. See also Stukeley, 'On the Causes of Earthquakes', where 'electricity seems, as it were, an animating soul to matter', 646.
20. Bodleian Library MSS. Eng. Misc. e.129, 58–59. See also Kléber Monod, *Solomon's Secret Arts*, 176.
21. Stukeley, 'The Philosophy of Earthquakes', 746.
22. Bodleian Library MSS. Eng. Misc. d.719/13.
23. *Ibid.*, 9.
24. *Ibid.*, 11.
25. *Ibid.*, 13.
26. *Ibid.*, 13–15.
27. *Ibid.*, 16.
28. *Ibid.*
29. Bodleian Library MSS. Eng. Misc. e.129, 8.
30. Bertucci, 'Back from Wonderland', 200. See also Bertucci, 'Sparking Controversy', 164; Schaffer, 'Self Evidence', 344; Priestley, *History and Present State*, 143; Franklin, *Benjamin Franklin's Experiments*, 234.
31. Bodleian Library MSS. Eng. Misc. e.129, 23–24. See also Nollet, 'Extract of a Letter', 383.
32. Bertucci, 'Back from Wonderland', 195. See also Riskin, *Science in the Age of Sensibility*, 76.
33. Syson, *Doctor of Love*, 137.
34. Mesmer, *Mesmerism*, 54; Graham, *Lecture on the Generation (1783)*, 18.
35. Fulford, 'The Electrifying Mrs Robinson', 26.
36. Mesmer, *Mesmerism*, 28.
37. Syson, *Doctor of Love*, 138.
38. Riskin, *Science in the Age of Sensibility*, 191.
39. Ruston, *Creating Romanticism*, 64.
40. *Report of Dr. Benjamin Franklin*, 98.
41. Riskin, *Science in the Age of Sensibility*, 222. See also *ibid.*, 192, 217.
42. Schaffer, 'Self Evidence', 349.
43. *Ibid.*, 357.
44. *Report of Dr. Benjamin Franklin*, 76–77.
45. Porter, 'Sexual Politics', 200.
46. Porter and Hall, *The Facts of Life*, 177; Fara, *Sympathetic Attractions*, 58; Otto, *Multiplying Worlds*, 68.
47. Graham, *A Sketch*, 43.

48. David Garrick to Madam Clairon, August 1769, *The Private Correspondence*, vol. I, 359.
49. *Diary or Woodfall's Register*, 10 November 1789.
50. *Whitehall Evening Post*, 12 October 1797.
51. Graham, *Guardian Goddess of Health*, 11, 17.
52. Kinnersley 'Course of Experiments', 412.
53. Syson, *Doctor of Love*, 64–65; Gale, *Electricity or Ethereal Fire*, 141–142; Benes, 'Itinerant Physicians', 108.
54. Graham, *Short Inquiry*, 7–8. See also Graham, *A Lecture on the Generation* (1783), 37.
55. Graham, *A Lecture on the Generation* (1780), 58.
56. *Ibid.*
57. Graham, *Short Inquiry*, 8–9. See also Graham, *Travels and Voyages*, 38, Porter, 'Sexual Politics', 200.
58. Graham, *The General State*, 68.
59. Graham, *A Lecture on the Generation* (1783), 18. See also Graham, *The General State*, 139.
60. Schaffer, 'Self Evidence', 335.
61. Graham, *A Sketch*, 29.
62. *Ibid.*, 29–30.
63. Graham, *Guardian Goddess of Health*, 33; Graham, *A Short Extract*, 26.
64. Graham, *A Sketch*, 43, 17; Delbourgo, *A Most Amazing Scene*, 156; Fara, *Entertainment for Angels*, 80–81.
65. Graham notes that other parts of his equipment have come from 'Mr Cox's stupendous museum', another spectacular venue. Russell, *Women, Sociability and Theatre*, 101, 144–145.
66. Graham, *A Sketch*, 17.
67. *Ibid.*, 7.
68. *Ibid.*, 6–7.
69. *Ibid.*, 14.
70. *Ibid.*, 14.
71. Porter, *Facts of Life*, 112.
72. Syson, *Doctor of Love*, 135.
73. Fara, *Entertainment for Angels*, 87–88.
74. Graham, *A Sketch*, 6.
75. *The Quacks*.
76. *The Semi-Globes*, 8.
77. *The Torpedo*, 10.
78. Graham, *The General State*, 17; Graham, *The Guardian Goddess*, 2–3.
79. Graham, *A Sketch*, 17–18. See also Graham, *The Guardian Goddess*, 7; Graham, *A Short Extract*, 1.

80. Graham, *A Sketch*, 6. Compare Priestley, *Experiments and Observations* (1777), 392. Graham also perhaps anticipates the work of Thomas Beddoes and Humphry Davy.
81. Graham, *A Sketch*, 15.
82. Graham, *The Guardian Goddess*, 12.
83. Schaffer, 'Self Evidence', 344.
84. Graham, *Short Extract*, 3. See also Graham, *The Guardian Goddess*, 26.
85. Graham, *Il Convito Amorosol* 53.
86. An earlier reference can be found in Oliver Goldsmith, *A History of the Earth*, vol. VI, 261.
87. Graham, *The General State*, 11.
88. 'Here the imagination may have full play, in conceiving of the manner in which an invisible agent produces an almost infinite variety of visible effects. As the agent is invisible, every philosopher is at liberty to make it whatever he pleases.' Priestley, *History and Present State*, vol. II, 16, quoted in Otto, *Multiplying*, 66.
89. Graham, *The Guardian Goddess*, 15–16. See also Graham, *A Sketch*, 22.
90. Brown, *Elementa Medicinae*. We do not know whether Brown and Graham were acquainted, but they are depicted together in John Kay's Edinburgh portraits, where a diminutive Graham stands directly behind Brown. Kay, 'John Brown'.
91. Graham, *The Guardian Goddess*, 18. See also Graham *A Lecture on the Generation* (1780), 23–24. Franklin, *Benjamin Franklin's Experiments*, 229.
92. Graham, *The Guardian Goddess*, 39. See also *A Short Extract*, 27.
93. Otto, 'James Graham', 218.
94. Graham, *The General State*, 11.
95. Graham, *A Sketch*, 21.
96. Graham, *A Sketch*, 12–13.
97. Otto, 'James Graham', 206.
98. *Ibid.* See also *ibid.*, 209.
99. Graham, *A Sketch*, 43.
100. Graham, *The Guardian Goddess*, 20.
101. *Ibid.*
102. Syson, *Doctor of Love*, 220.
103. Graham, *A Lecture on the Generation* (1783), 8.
104. Graham, *A Short Inquiry*, 11–12.
105. James Graham, *Advertisement*, 1–2.
106. Graham, *A Lecture on the Generation* (1783), 18. See also *A Lecture on the Generation* (1780), 57–59.
107. *A Lecture on the Generation* (1783), 18.
108. *Ibid.*
109. *Ibid.*

110. Graham, *A Lecture on the Generation* (1783), 16. See also *A Lecture on the Generation* (1780), 49–50.
111. Graham, *A Sketch*, 47. Graham does include a longer and more lavish description of the pleasures of the bed in his ‘Private Advice to Married Ladies and Gentlemen’, reprinted in *The Guardian Goddess*; Graham, *A Lecture on the Generation* (1780), 23; Porter, *Facts of Life*, 115.
112. Graham, *Il Convito Amorosolo!* 6.
113. *Ibid.*, 7.
114. *Ibid.*, 58–59.
115. *Ibid.*, 54–55.
116. *Ibid.*, 65–66.
117. *Ibid.*, 66. See also Kinnersley, *Pennsylvania Gazette* (18 April 1751).
118. Graham *A Lecture on the Generation* (1783), 22.
119. *Ibid.*
120. In *The Man in the Moon*, a satire on Charles James Fox, the King of the Moon remarks matter-of-factly to Fox that ‘Dr Graham . . . does not always speak nonsense. The tender intercourse which he pretends to improve . . . is, in reality, an electrical operation.’ Thomson, *The Man in the Moon*, vol. II, 24.
121. Graham, *A Lecture on the Generation* (1783), 21.
122. *Ibid.*
123. Otto, ‘James Graham as Spiritual Libertine’, 212–213.
124. Graham, *A Lecture on the Generation* (1783), 20.
125. See ‘A Song Introductory to the Celestial Bed’, *Morning Herald* and *Morning Chronicle*, 26 July 1781; *Public Advertiser*, 27 July 1781.
126. Syson, *Doctor of Love*, 243–245.
127. Mee, ‘Reciprocal Expressions’, 112.
128. Guest, *Unbounded Attachment*, 38–39.
129. Fulford ‘The Electrifying Mrs Robinson’.
130. Guest, *Unbounded Attachment*, 50.
131. Mason, *The Celestial Beds*, 19.
132. *Ibid.*, 26.
133. *Ibid.*, 8.
134. Fulford, ‘The Electrifying Mrs Robinson’, 31.
135. Robinson, *Walsingham*, vol. II, 227; vol. III, 22–23.
136. McGann, *Poetics of Sensibility*.
137. Esterhammer, ‘Spontaneity, Immediacy’, 323.
138. Jackson, *Science and Sensation*, 6.
139. *British Album*, vol. I, 30–31.
140. *British Album* vol. II, 144–145.
141. *Ibid.*, 149.
142. Mee, *Romanticism, Enthusiasm*, 233.
143. Delbourgo, *A Most Amazing Scene*, 4–5.

144. Robinson makes electricity a figure for poetic inspiration in her 'Ode to Genius' celebrating the 'electric fire that fills the MUSE'. Robinson, *Poems*, 126.
145. McGann, *Poetics of Sensibility*, 81.
146. Mee, 'Reciprocal Expressions', 109.
147. Quoted in Mee, 'Reciprocal Expressions', 111–112.
148. Merry, *Laurel of Liberty*, 198.
149. *Ibid.*, 199.
150. *Ibid.*, 206.
151. *Ibid.*
152. *Ibid.*, 210.
153. Rudy, *Electric Meters*, 31.
154. Robinson, *Ainsi va le Monde*, 220, 221.
155. *Ibid.*
156. *Ibid.*, 224.
157. *Ibid.*, 224–225.
158. Graham, *A Sketch*, 20.
159. *Moral and Political Magazine*, vol. I, 239–40; *The Telegraph*, 1 July 1796.
160. Guest, *Unbounded Attachment*, 45; Mee, 'Reciprocal Expressions', 112.
161. Merry, *Ode for the Fourteenth of July*, 250.
162. Mee, *Romanticism, Enthusiasm*, 225; Mee, 'Reciprocal Expressions', 112; Guest, *Unbounded Attachment*, 45.
163. Merry's chorus becomes a kind of byword for toasting and is cited in the *Public Advertiser*, 15 July 1791, and *Roach's London Pocket Pilot*, 7.

Animal Electricity, Vitality, and Revolution

In the early 1790s, ideas about the connection between electricity and a physiological life force changed, developing from hints to a full experimental programme and philosophical analysis of an electrical ‘vital spirit’. Luigi Galvani’s claims for a physiological form of animal electricity produced for the first time experimental ‘proof’ of the connection between electricity and animal life. These claims for electricity’s vital function were incorporated into literary and political discourse in the 1790s, as electricity was increasingly often evoked as a symbol of political vitality, as we have seen in the work of Merry and Robinson. Commentators represented the communication of political ideas using a language of electricity, and radical writers in particular celebrated an innate electrical political vitality which often lies dormant, but which might be stimulated into life. Critics and historians have noted the increased visibility of electrical language in political discourse at this period. Iain Hampsher-Monk claims that electric communication became ‘a favoured neologism’ to account for ‘the political mobilization of hitherto unpoliticised people’, while Tim Fulford suggests that ‘electricity came, in the 1790s, to be a symbol of revolution’.¹ But though electrical language pervades discussions of revolution in France and reform in Britain, electric discourse was not a straightforward means of celebrating radical activity. New investigations of electrical vitality altered understandings of electricity’s effects, but the idea of an electrical life force was adapted in a range of ways in discussions of

revolutionary processes. It offered radicals a powerful means of claiming reformist activity as natural and salutary, but these claims were by no means rhetorically stable. Counter-revolutionary and conservative commentators declared that the collective actions of political crowds found life through a communicative electric process, and at a more abstract level they condemned the obscure life force of the French Revolution itself by evoking the occult qualities of electric vitality. For reformist writers too the obscurity of electric communication often proved a problem. The difficulty of analysing and explaining an electrical life force meant that it could not be straightforwardly harnessed to a progressive cause.

In this chapter, I investigate the ways in which a discourse of electrical vitality informs accounts of political activity and communication during the 1790s.² The diversity of political and literary appropriations of electrical language indicates the fundamental instability of understandings of electricity even at the close of the century. Electrical language is thus used by conservative commentators to condemn what they see as the equally indeterminate and speculative actions of revolutionists. But this instability creates productive rhetorical space, which enables commentators of all kinds to appropriate vital electrical discourse to engage with unprecedented events. I begin and end the chapter with analyses of physiological investigations of electricity by commentators who advocate no distinction between natural philosophical, literary and political discourse, and who emphasise the political implications of their natural philosophical findings – Erasmus Darwin and John Thelwall. Such refusal to distinguish between philosophy and politics brought a heavy toll for Darwin and Thelwall. Their work illustrates both the opportunities and the high stakes of detailed engagement with vital electrical forces, and demonstrates the wild and varied political implications of investigations of electrical vitality during this period.

I LUIGI GALVANI AND ERASMUS DARWIN

Galvani's animal electricity experiments had an enormously wide and powerful influence on investigations of electricity and vitality at this period. Here I focus on the connections between Galvani's work and that of Erasmus Darwin, who adapted philosophical investigations of electric vitality in order to make a case for political reform in Britain, and who made his most daring claims in a series of philosophical poems. Darwin was a celebrated physician who sought to bring medical practice together

with natural philosophical research. He focused on philosophical practices that might have therapeutic applications, experimenting with gases and electricity over many years. In his youth, like many of his contemporaries, he speculated about the nature of the connection between electricity and the soul, declaring in a letter to his friend Albert Reimarus that the *anima* is ‘so fine that it cannot be imprisoned in the body’ and comparing it with electricity.³ Darwin’s interest in immaterial aethers was altered, however, by the discoveries in the 1770s of the Torpedo and Gymnotus electric fish, whose bodies possessed the ability to produce an electric shock. These examples of animal electricity prompted him investigate its vital functions, drawing on the work of John Hunter in Britain, and Luigi Galvani and Alessandro Volta in Italy. Darwin’s philosophical poems, in particular *The Economy of Vegetation* (1791), demonstrate his interest in an electric vital spirit, and this connection between electricity and life is even more explicit in his treatise *Zoonomia, or, the laws of organic life* (1794), in which he engages with the work of Galvani. While the ‘spirit of animation’ that Darwin discusses in *Zoonomia* is not Galvani’s ‘animal electricity’, both men uphold the possibility that electricity constitutes a ‘vital spirit’, which distinguishes living bodies from the dead. In contrast to Galvani, Darwin was criticised for the suggestion that electricity might be a material life force. The reception of his work demonstrates the political high stakes of adopting a speculative language of vitality in scientific or in literary discourse during the 1790s in Britain.

Galvani published his claims for an electrical principle of life, or ‘animal electricity’ in his *Commentary of the Effects of Electricity on Muscular Motion* in 1791, though he made the experiments which led to this ‘discovery’ in the 1780s, and had been researching the connections between ‘medicine, chemistry and physics’ for many years previously.⁴ In the *Commentary*, Galvani explains that while dissecting frogs, he observed that electricity caused the muscles of the frogs’ legs to contract. He deduced that such contraction proved the existence of what he terms ‘animal electricity’ in the nerves and muscles. The existence of an electrical life force had long been a topic of debate at Galvani’s institution, the University of Bologna, but his *Commentary* now supplied evidence to prove it.⁵ Galvani stresses the utility of his discovery not only in the field of natural philosophy, but also in the electrical treatment of disease.⁶ His claims for the nature of the ‘nerve fluid’ are cautious; he posits a figurative connection between this fluid and electricity, following other theorists of imponderables.⁷ ‘A kind of circuit of a delicate nerve fluid is made from

the nerves to the muscles when the phenomenon of contractions is produced, similar to the electric circuit which is completed in a Leyden jar.⁸ But Galvani strengthens his claims, insisting that this ‘nerve fluid, (an electric fire, as it were)’ is distinct from electricity, though they have ‘qualities’ in common.⁹ These are bold claims, but Galvani makes no attempt to explain the operations of animal electricity on physical or other grounds. Despite the obscurity of his claims, however, Galvani’s work was hugely influential.¹⁰ He had formulated for the first time an apparently empirical connection between electricity, the operations of the nerves, and the vital spirit, thus enabling commentators of all kinds to claim electricity as a vital force.

As L. S. Jacyna notes, Galvani’s claims were soon taken up in Britain. Edinburgh University researchers set up a programme to test his account of animal electricity, but it proved extremely difficult to categorise.¹¹ Writing in 1804, Charles Wilkinson traces the development and application of Galvani’s work since 1791, but in conclusion, notes that

the phenomena of galvanism are in a manner supernatural. In repeating the experiments, it would appear that the inquirer would be enabled to penetrate the great secret of life and animality . . . The spectator who witnesses . . . [it] is almost led to entertain a hope that death may finally be averted.¹²

Even in more than ten years since the publication of Galvani’s *Commentary*, experimenters have failed to explain his animal electricity. The vital, electrical properties of the ‘Galvanic influence’ remain obscure yet powerful, to the extent that Wilkinson can only describe this ‘great secret’ as ‘in a manner supernatural’. Darwin articulates a radical optimism about the progress of philosophical investigations, but he too is fascinated by this obscure operation of electrical forces. In contrast to his contemporaries, Darwin did not just engage with electrical phenomena in prose works but also in poetry of various kinds. The varied forms of his writings enable him to investigate and exploit the obscure, figurative connections between electricity and life.

Darwin investigates the suggestion that animal vitality might have an electrical cause in his medical and his experimental practice, drawing on Galvani’s work in his *Zoonomia*.¹³ But in contrast to Galvani, he saw a special function for poetry in outlining and exploring abstruse or obscure philosophical matters, such as the apparently ‘supernatural’ connections between electricity and life. Though Darwin may not

have read Galvani's work until 1793 he investigates many of the concerns of Galvani's *Commentary in The Economy of Vegetation*, positing, like Galvani, some 'unity between the organic and inorganic realms'.¹⁴ Darwin does not make explicit claims for the connection between electricity and life in *Zoonomia* or the poetry. As Martin Priestman notes, "'vitality" is an "ethereal flame" we cannot fully explain, though it does belong . . . completely to the world of matter' for Darwin; but in contrast to Galvani, he 'did not literally believe that life was some form of electricity'.¹⁵ In his poetry, however, Darwin does explore the connections between electricity and life; indeed he seems to find poetry the most conducive form for such speculative discussion. Introducing *The Economy of Vegetation*, he apologises that the 'conjectures' that follow may not be 'supported by accurate investigation or conclusive experiments'. But in the absence of experimental proof, he emphasises the importance of figurative connections between distinct phenomena:

Extravagant theories . . . in those parts of philosophy, where our knowledge is yet imperfect, are not without their use, as they encourage . . . [us] to confirm or refute them. And since natural objects are allied to each other by many affinities, every kind of theoretic distribution of them adds to our knowledge by developing some of their analogies.¹⁶

Poetry enables the investigation of such figurative connections, in a way that philosophical treatises cannot. Darwin addresses the distinctions between poetic figure and philosophical analogy in the Advertisement to *The Economy of Vegetation*. It seems that philosophical reasoning is the dominant discourse, to which poetry must conform; the 'general design' of the work 'is to inlist imagination under the banner of Science; and to lead her votaries from the looser analogies, which dress out the imagery of poetry, to the stricter ones, which form the ratiocination of philosophy'.¹⁷ But the poem itself suggests an alternative logic; poetry might be the medium through which science is enlisted under the banner of imagination. The poet does not leap to strict 'analogy', but in more playful fashion teases out figurative connections between phenomena before moving to 'ratiocination'. Darwin uses his verse and the extensive accompanying notes, to investigate the connections between 'the organic and inorganic realms', and between electricity and physiology.

Each of the four cantos of *The Economy of Vegetation* investigates one of the four ancient elements, as the Goddess of Botany addresses in turn the salamanders of fire, the gnomes of earth, the nymphs of water and the sylphs of air. In canto one Darwin discusses fire, and demonstrating his detailed knowledge of electrical practices. He cites developments in electrical investigation as evidence for progress in science, which he celebrates in the style of Priestley. But electricity has a tendency to complicate such accounts. The Goddess tells of the electric provenance of the aurora borealis, investigates the physiology of the Torpedo and Gymnotus electric fish, and suggests an electrical cause of phenomena from the sparking of flints to atmospheric conditions for the germination of plants.¹⁸ Darwin then moves to a detailed representation of the electrical experiments popularised by Martin and Rackstrow. In a vivid account the Goddess describes how

fine hands ethereal floods amass
 From the warm cushion, and the whirling glass;
 Beard the bright cylinder with golden wire,
 And circumfuse the gravitating fire . . .
 While paper nymphs instinct with motion rise
 And dancing fauns the admiring Sage surprise,
 Or, if on wax some fearless beauty stand,
 And touch the sparkling rod with graceful hand,
 Through her fine limbs the mimic lightnings dart,
 And flames innocuous eddy round her heart;
 O'er her fair brow the kindling lustres glare,
 Blue rays diverging from the bristling hair;
 While some fond youth the kiss ethereal sips
 And soft fires issue from their meeting lips.¹⁹

This is an accurate account of such experiments, but Darwin emphasises their delightful effects which surprise both the young participants and the ‘admiring Sage’, and their erotic implications. Darwin’s note observes that ‘the theory of the accumulation of the electric fluid by means of the glass-globe and cushion is difficult to comprehend’.²⁰ But neither speaker nor poet seem unnerved by this mystery; rather, as in the Della Cruscan poetry of Robinson and Merry, Darwin delights in the way electric language gestures to physical sensations for which there is no vocabulary. The obscurity of these phenomena enables Darwin to practise a form of speculation, for which he has prepared the reader in his Apology. Thus his

investigation moves beyond a celebration of electricity's mysteries. Uncertainty for Darwin encourages further investigation and stimulates future progress.

However, this mystery deepens as canto one moves from 'artificial' experiments to speculations about electricity's vital functions. In lines reminiscent of the Della Cruscan the Goddess describes the progress of

the quick Ether through the fibre-trains
Of dancing arteries, and of tingling veins,
Goads each fine nerve, with new sensation thrill'd,
Bends the reluctant limbs with power unwill'd.²¹

Though he uses an aethereal language associated with immaterial accounts of electricity, Darwin's electrical force is material; it forces the fibres of the body into action. Electricity appears to be a force operating from without on the body, but Darwin's speculative reasoning considers another alternative. The Goddess notes how:

Palsy's cold hands the fierce concussion own,
And Life clings trembling on her tottering throne,
So from dark clouds the playful lightning springs,
Rives the firm oak, or prints the Fairy-rings.²²

Darwin's note to these lines suggests that electricity is not an external stimulus but an innate cause of muscular motion, and even life itself.

The temporary motion of a paralytic limb is . . . caused by passing the electric shock through it; which would seem to indicate some analogy between the electric fluid, and the nervous fluid . . . [Electricity] probably destroys life by its sudden expansion of the nerves or fibres of the brain; in the same manner as it fuses metals and splinters wood or stone.²³

Darwin's notes are remarkably tentative, but he makes a striking claim for the connection between electricity and life, which is enabled by the poetic form he has chosen for his speculations. The simile constructed in 'So from dark clouds' in the verse strengthens into a more formal 'analogy' in Darwin's notes, where electricity's observed effects are evidence of its comparable operation in the nerves. The indeterminacy of electrical

imagery seems to work in Darwin's favour here, becoming a crucial example of the way figurative suggestion can harden into philosophical analogy.

Darwin does not limit his speculation to 'philosophical' matters. The Goddess moves from experiment and hypothesis in natural philosophy to their application in politics. The figure who enables this pivot is Franklin, a philosophical hero to Darwin and to many radicals whose career, as critics and historians have noted, was a key element in the association of electrical language with radical politics.²⁴ Darwin's discussion demonstrates how Franklin's leadership of American revolutionary agitation combined with his control of lightning produced the association between electricity and revolutionary communication. In Darwin's verse the nymphs

led your FRANKLIN to your glazed retreats . . .
 Bade his bold arm invade the lowering sky,
 And seize the tiptoe lightnings, ere they fly;
 O'er the young Sage your mystic mantle spread,
 And wreath'd the crown electric round his head.²⁵

Though the accompanying note is concerned with the details of Franklin's experiments, the verse develops the figurative connection between these experiments and the Promethean act of disarming British tyranny.²⁶ But the figurative implications of the electrical language are uncertain, as the 'crown electric' also seems to set up Franklin in authority over electricians and over the populace.²⁷ And the political uncertainties of Darwin's account increase as he suggests the further Promethean implications of Franklin's actions. Prometheus not only steals fire from the heavens but bequeaths it to humankind, and thus gives life to humanity.²⁸ Darwin thus suggests the connection between electricity, reformist politics, and the 'spirit of animation', in an echo of Robinson's suggestion at the close of *Ainsi va le Monde*.²⁹ In arguing for an electrical political vital spirit, Darwin articulates an idea that finds rich and varied rhetorical life in reformist and conservative writings in the 1790s. But he returns to 'the spirit of animation' and its political implications in canto two, and finds that such revolutionary political vitality is not a straightforward cause of celebration.

The second canto sets out Darwin's enthusiasm for the French Revolution, and he connects those events with revolution in America.³⁰ This canto addresses the gnomes of earth, and celebrates achievements in

mining and geology, but Darwin returns to his celebration of Franklin, and develops his investigation of electricity, life and liberty. The Goddess notes how

Immortal FRANKLIN sought the fiery bed;
Where, nursed in night, incumbent Tempest shrouds
The seeds of Thunder in circumfluent clouds,
Besieged with iron points his airy cell,
And pierced the monster slumbering in the shell.³¹

As in canto one, Franklin's lightning rods make safe omnipotent power. But again Darwin's evocation of an electrical political force is less positive than might be assumed. He describes this power as monstrous, not divine. Darwin seems fascinated by obscurity in philosophy, almost evoking Hamilton's 'supernatural' galvanic forces. In this passage, obscurity in politics mutates into a gothic force. In America, 'When Tyrant-Power had built his eagle nest;/While from his eyry shriek'd the famish'd brood,/Clenched their sharp claws, and champ'd their beaks for blood', Franklin and his followers responded to this monstrous tyranny with an explicitly electrical political animation and energy:

Immortal Franklin watch'd the callow crew,
And stabbed the struggling vampires, ere they flew.
The patriot-flame with quick contagion ran,
Hill lighted hill, and man electrified man;
Her heroes slain awhile COLUMBIA mourned,
And crown'd with laurels LIBERTY return'd.³²

Again the figures of tyranny are monstrous; the British state feeds in vampiric fashion on its colonies. Darwin celebrates the revolutionary communication that resisted such tyranny; his electric metaphor is a figure for the means through which information and energies were transmitted from community to community. It also gestures to Darwin's account of the electrical 'spirit of animation' in canto one. Though contagious, this electrical 'patriot-flame' is a salutary force comparable to those celebrated by Robinson and Merry. Darwin makes it a physiological form of energy, which as Fulford notes, 'surge[s] through the sinews, nerves and minds of all Americans, electrifying them into belief and battle'.³³ Here electric communication is an enlightening force of resistance to gothic tyranny,

but in the following lines the significance of this communication alters as Darwin focuses on its physiological causes and effects.

Darwin makes the connection between electricity, monstrosity and political struggle, noting how Ireland has been animated by the spirit of liberty, before turning to events in France. He makes the populace of France a giant figure battling against monstrous forces, and enabled by electrical political animation:

Long had the Giant-form on GALLIA'S plains
 Inglorious slept, unconscious of his chains . . .
 —Touch'd by the patriot-flame, he rent amazed
 The flimsy bonds, and round and round him gazed;
 Starts up from earth, above the admiring throng
 Lifts his Colossal form, and towers along;
 High o'er his foes his hundred arms He rears,
 Plowshares his swords, and pruning hooks his spears.³⁴

Reformists in Britain interpreted this passage as a critique of tyranny and even a call to arms; it was anthologised in Daniel Isaac Eaton's *Politics for the People, or a salmagundy for swine* in 1794, and quoted widely.³⁵ But Darwin's celebration is ambivalent. The 'giant-form' is himself monstrous; he performs the opposite of the peacemaking of God in the Book of Isaiah; he does not mediate between nations but rather promotes conflict, and he turns ploughshares and pruning hooks into weapons.³⁶ Though the Goddess praises the 'giant-form' for inspiring the 'good and brave', the monstrosity earlier associated with tyranny has shifted to the forces of democratic might. Darwin's ambivalence arises from and is articulated through the obscurity of his electrical animating power. It is not possible to police the limits of that power, and likewise Darwin struggles to separate the monstrous language of this verse from its celebratory aims. Despite its association with Franklin, electrical vitality cannot simply be cited as a symbol of reform and progress, as its obscurity evokes a gothic order of political threat.

Darwin's account of electricity and life in *Zoonomia* seems to confirm the anxieties suggested in his poetry. As in the Apology to *The Economy of Vegetation*, Darwin notes that figurative language has a different function in philosophy and in poetry, but he differentiates more strongly between the two discourses, suggesting the need to limit the proliferative effects of electrical signification. 'Rational analogy' is rightly founded on the

‘similitude on the features of nature’, and when used with propriety ‘leads us to many and important discoveries’. But on the contrary ‘when with licentious activity it links together objects . . . by some fanciful similitude; it may indeed collect ornaments for wit and poetry, but philosophy and truth recoil from its combinations’.³⁷ While Darwin exploited ‘fanciful similitude’ in his poetic work, he now pledges to restrict ‘licentious activity’. *Zoonomia* takes up the question of galvanic forces and the ‘principle of animation’, but Darwin presents a more sceptical assessment of the connections between electricity and life. However, he maintains a suggestion of the importance of figurative language for articulating the obscure findings of his physiological-electrical experiments.

In an exploration ‘of fibrous contraction’ Darwin reminds his readers that the Leyden jars he uses in his experiments have a figurative relation to physiological phenomena: ‘The contraction of a muscular fibre may be compared to the following electrical experiment, which is here mentioned not as a philosophical analogy but as an illustration or simile to facilitate the conception of a difficult subject.’³⁸ This simile does not have the force of a philosophical analogy, but it is a useful means of articulating a relation between inorganic and organic processes. Darwin concludes ‘that animal contraction is governed by laws of its own, and not by those of mechanics, chemistry, magnetism, or electricity’.³⁹ He distances his work from attempts ‘by Galvani, Volta, and others, to shew a similitude between the spirit of animation . . . and the electric fluid’, declaring that electricity acts only as a ‘stimulus exciting the muscular fibres into action, and not by supplying them with a new quantity of the spirit of life’.⁴⁰ But as Paul Elliott notes, Darwin sometimes suggests in *Zoonomia* that ‘the spirit of animation . . . [is] akin to a subtle fluid or essence, close to Galvani’s animal electricity’.⁴¹ Darwin’s eye for figurative connections, whether of similitude or analogy, means that he sustains his suggestion of a connection between electricity and life. Darwin asserts that matter functions in the same way in organic as in inorganic bodies, and is thus able to claim that the ‘spirit of animation’ has an analogous relation with ‘heat, electricity, and magnetism’.⁴² Here Darwin maintains his support for interpretive openness in discussions of electricity, but this kind of speculation is rare in *Zoonomia*.

Darwin’s caution in *Zoonomia* suggests an increased ambivalence about the proliferation of meanings enabled by electrical language, especially when connected with the communication of political ideas. This is perhaps a response to the increasing polarisation of political discourse since the

French Revolution. Darwin increasingly found to his cost that ‘the perceived association between natural philosophy, electricity and reform’ marked his works out for censure.⁴³ The *Anti-Jacobin, or Weekly Examiner*’s immensely successful parody of Darwin’s work ‘The Loves of the Triangles’ seizes on the apparent connection between Darwin and Galvani’s work, and the latter’s suggestion that ‘the electric fluid is the proximate cause of nervous sensibility’.⁴⁴ Such electric sensibility destroys the heroine Mathesis’s virtue: ‘Still run her fond hallucinating eyes;/ Thrills with *Galvanic* fires each tortuous nerve, /Throb her blue veins, and dies her cold reserve’.⁴⁵ The *Anti-Jacobin* delights in the ridicule of Darwin, and as Maurice Crosland has discussed, Priestley was the object of even more sustained attack for the radical political implications of his researches.⁴⁶ This reached such a height that Priestley’s friend Adam Walker declared in 1799 that ‘philosophy has of late been branded as the cause of mischief by those whose interest it is to promote ignorance and slavery in the world’.⁴⁷ Darwin’s celebration of electric patriotism in 1791 seems impossible in 1799. But despite the association between electricity and heterodox political and religious views in the 1790s, we should resist the tendency to assign all such electrical writings a reformist character. Electrical language is used to account for revolutionary activity of all kinds by writers of all political stripes. A huge range of writers evoke the connection between electricity and revolutionary discourse during the 1790s. Galvani’s and Darwin’s hints at the obscure operations of electrical vitality produce a provocative but disturbingly mobile language of electrical communication which seems irresistible to both reformers and counter-revolutionaries, but such language resists straightforward application to any political view.

2 JOHN COURTNEY

The spread of revolutionary fervour is described by both reformist and counter-revolutionary writers as an electrical force, but such imagery has strange effects on the structure and expression of their claims. John Courtney’s pamphlet *Philosophical Reflections on the late Revolution in France* (1790) demonstrates the unsettling effects of electrical language for political polemic. On 11 June 1790 Frances Burney writes to a friend of a recent conversation about Courtney’s pamphlet with his fellow parliamentarian William Windham. Burney’s letter emphasises the indeterminate status of Courtney’s pamphlet, gesturing to the peculiar ways in which a

language of electricity informs accounts of the French Revolution from its earliest days. Burney relates a series of misreadings. First she ‘thought the printer sent it to a wrong person’ but then saw that Courtney had personally addressed it to her. Her confusion continued though: ‘I read the title-page, and finding it a political pamphlet, I next concluded it was sent to me by way of being laid in sight of the higher powers’; she imagined Courtney wrote to exploit her connections with the royal family.⁴⁸ But she was proved wrong again on opening the pamphlet, as Courtney criticises the government’s stance on the French Revolution.⁴⁹ However the generic status of his work is still uncertain, and produces one more misreading:

I supposed . . . that he had sent it me for my instruction and entertainment in the parts not political . . . but no, – I soon found my second mistake as egregious as my first: ’tis all of one colour – and such a colour! Church, State, politics and religion, – I know not which is treated worst.⁵⁰

A passage which derides the Prince of Wales proves the final straw: ‘Away went the book in hearty indignation, and I have looked at it no more.’⁵¹ Burney and Windham critique both the form and content of Courtney’s pamphlet, noting that it is ‘all irony from period to period . . . [and] rather wearisome than poignant when thus spun on’.⁵² But despite their attempt to stabilise the meaning of the *Philosophical Reflections*, Burney’s initial misreadings demonstrate its radical uncertainty.

Courtney declares in a provocative opening statement:

I am not in the least surprised that some of the most enlightened men of the present age . . . are seriously alarmed at the dangerous and rapid progress of democracy in France. We had indeed little to fear, whilst they enjoyed that serene and tranquil state of government, uniformly resulting from the unlimited power of a monarch . . . But now, *horresco referens*, [the people] no longer acknowledge ‘The right divine of kings to govern wrong’; and . . . on abstract metaphysical principles (unhappily reduced into practice) assert the unalienable right of man to freedom: – The fatal consequences are obvious; as . . . the tranquillity and happiness of a well regulated community can only be maintained by implicit obedience and unconditional submission.⁵³

The clear target of Courtney’s satire is abuse of government in France and in Britain; however, his pamphlet occupies a peculiar place in the British ‘debate’ over French revolutionary principles, as it oddly anticipates later counter-revolutionary writings.⁵⁴ Courtney ironically critiques the

diffusion of revolutionary principles, declaring: ‘A constellation of genius seems united in propagating these dangerously atheistical tenets. They were diffused in every species of writing, and the dulcet poison was greedily imbibed in every part of Europe.’⁵⁵ As a result, ‘the venerable Gothic structure was shaken from its very foundation; the sacred edifice was laid low, and the madness of democracy has vainly dedicated a temple to liberty on its ruins’.⁵⁶ Courtney’s pamphlet appears seven months before Edmund Burke’s *Reflections on the Revolution in France*, but it anticipates much of Burke’s rhetoric.⁵⁷ He asserts, ‘a truth of this dangerous tendency should ever be concealed from the vulgar . . . They were happy and content when they looked up to the great ones of the earth, as beings of a superior order; but the pleasing delusion from whence they enjoyed so much felicity will quickly vanish’, foreshadowing Burke’s claim that ‘All the pleasing illusions, which made power gentle and obedience liberal . . . and which . . . incorporated into politics the sentiments which beautify and soften private society, are to be dissolved by this new conquering empire of light and reason.’⁵⁸ Burney’s unsure response to Courtney’s pamphlet goes beyond her declared ‘ignorance’ of politics. She seems to intuit the uncertain status of its political intervention. The unstable, proleptic quality of Courtney’s prose is most clearly signalled in his warning of the electrical spread of revolutionary principles from France to Britain.

Courtenay describes the propagation of revolutionary ideals, declaring:

I have forewarned Britain of her danger. The . . . stability of every throne is shaken, by the late political convulsion; the shock is not confined to France; it acts like ‘the electrical returning stroke, which often produces fatal effects at a vast distance from the place where the lightning falls’.*

* *Principles of electricity*, by Lord Mahon, 1779.⁵⁹

This description of revolutionary communication as an ‘electric returning stroke’ is no arbitrary allusion. His footnote cites Lord Mahon’s explanation for the electrical phenomenon in which ‘in violent Thunder storms . . . Persons, at great distances from each other, have been all *knocked down at once* . . . at the *very instant*, in which, some great explosion from the charged cloud took place’.⁶⁰ Mahon explains that this effect is caused by ‘an electrical returning Stroke, occasioned even by some *very distant Explosion* from a thunder-cloud’, proving his claims by experiment.⁶¹ Courtney thus makes a precise connection between revolutionary communication and contemporary electrical research.

Courtney asserts the destructive effects of French revolutionary principles, but the political implications of his reference are complex. Lord Mahon, author of *Principles of Electricity* is by 1790 Charles, Earl Stanhope, or Citizen Stanhope, Chairman of the London Revolution Society, friend of radical dissenters like Richard Price and Priestley, and Courtney's colleague in the radical wing of Parliament. In aligning his text with Stanhope's, Courtney connects electrical experimentation and reformist politics, and seems to unmask his satirical text as a critique of 'unconditional submission'. But the weirdly proleptic effects of his satire demonstrate how appropriations of electricity in the 1790s resist straightforward appropriation to a political cause. Conservative commentators' use of such imagery shows how electrical metaphors, like Courtney's text, communicate alarm, but cannot be relied upon to support counter-revolutionary ideologies. Electricity's obscure vital operation means that its significance is highly unstable. As Darwin suggests in the *Economy of Vegetation* and *Zoonomia*, electricity can signify a political life force, or mode of communication, or can shift into pernicious contagion.

3 CONSERVATIVE ALARM

Courtney's pamphlet anticipates counter-revolutionary descriptions of French revolutionary activity as electrical. Burke uses such language throughout the 1790s, but in doing so he draws on and engages with appropriations of electricity in a range of conservative writings, which figure electricity as an image for the press, for the actions of crowds, and for the occult and monstrous animating principle of 'revolution' itself. These writings draw attention to their own figurativeness, as electricity becomes a symbol for the way in which political communication has the potential to proliferate beyond control.

Burke himself uses electrical language in his *Reflections on the Revolution in France*. In an echo of Courtney's 'condemnation' of the 'propagat[ion of] these dangerously atheistical tenets' Burke declares:

We cannot be ignorant of the spirit of atheistical fanaticism, that is inspired by a multitude of writings, dispersed with incredible assiduity and expense... These writings and sermons have filled the populace with a black and savage atrocity of kind, which supersedes in them the common feelings of nature.⁶²

Burke makes the press the source of this diffusion.⁶³ Such ‘epidemic fanaticism’ acts like a force of nature:

To destroy any power growing wild from the rank productive force of the human mind is almost tantamount, in the moral world, to the destruction of the apparently active properties of bodies in the material. It would be like the attempt to destroy . . . the expansive force of fixed air in nitre, or the power of steam, or of electricity, or of magnetism. These energies always existed in Nature, and they were always discernible. They seemed, some of them unserviceable, some noxious . . . until contemplative ability . . . subdued them to use, and rendered them at once the most powerful and the most tractable agents, in subservience to the great views and designs of men.⁶⁴

Burke presents an interesting variation on Courtney’s use of electrical imagery. Electricity is one of a series of obscure ‘active properties’ in material bodies, both organic and inorganic. Though Burke presents its power as sublime, he also suggests that it can be harnessed, and put in the service of human ‘designs’. Burke’s statement is unusual, because he is prepared to acknowledge the possible social and moral benefit of natural philosophical endeavours.⁶⁵ As Crosland has noted, Burke often uses philosophical discourse, in particular chemistry and mathematics, to stress the falsely-rational, unfeeling ‘threat’ of revolutionary doctrine. But his use of electrical language is unique in its focus on the obscure animating principles of revolutionary activity.⁶⁶

Burke makes a more specific use of electrical language in his pamphlet *An Appeal from the New to the Old Whigs* of August 1791. He attacks what he sees as the hypocrisy of British radical societies’ support for revolutionaries in France:

They pretend that their doctrines are infinitely beneficial to mankind; but . . . they would keep them to themselves, if they were not greatly provoked . . . These cats, it seems, would not give out their electrical light without having their backs well rubbed. But this is not to do them perfect justice. They are sufficiently communicative . . . It is notorious, that they were proceeding as fast and as far, as time and circumstances would admit, both in their discussions and cabals . . . it is not to be denied, that they had opened a correspondence with a foreign faction, the most wicked the world ever saw.⁶⁷

Burke’s comments seem belittling. The practice of drawing electrical sparks from the fur of a black cat was commonly associated with Gustavus

Katterfelto, who, like James Graham, was dismissed as a charlatan.⁶⁸ *The World* newspaper of 6 August 1791 interprets them in this spirit: ‘Burke’s indomitable stroke at the *Revolutionists*, in which he compares them . . . to Cats, which, being rubbed, emit a kind of ELECTRIC LIGHT, is a rash of ridicule, at which the whole fraternity must *wince*.’⁶⁹ But Burke’s comment is more complex than *The World* allows, and his use of an electrical metaphor reflects this complexity. Burke shifts from ridicule to concern at the moment he describes radicals as ‘communicative’. He suggests that the acts of communication he describes in this passage – ‘discussions’, ‘correspondence’ – are a form of electrical communication that has a physiological source in a form of animal electricity, and whose influence travels ‘fast’ and ‘far’, and is indestructible.

In 1792 and 1793, in the aftermath of the September massacres and during the onset of the Terror, the use of electrical discourse in counter-revolutionary writings shifts, and electricity’s vital properties become increasingly threatening to counter-revolutionary commentators. The power of the French populace unsettles Darwin’s celebration of revolutionary communication in 1791, and in counter-revolutionary writings produced during the Terror, the electrical vitality of the populace is an even more significant threat. In his *Letter to the People of England* (1792), William Playfair, an English resident of Paris who had supported the early events of the Revolution, outlines his reason for his abandonment of the cause.⁷⁰ Playfair focuses on the pernicious power of revolutionary principles ‘to spread their doctrine, to excite discontents and occasion Revolutions’.⁷¹ He describes the Parisian press as a catalyst for physical unrest; newspapers become an instrument through which the ‘people . . . are stirred up by wicked and designing persons’.⁷² The result of this textual communication is physical disruption, which he describes in electrical terms. ‘When the brutal fury of the multitude . . . augments by a sort of electrical communication, [it] gives to the countenance of him who calls out for blood a sort of horrid appearance that neither merited vengeance nor the greatest degree of personal danger can equal.’⁷³ For Playfair like Burke, ‘electrical communication’ is an inexorable effect of the combination of revolutionary ideology and the printing press, but here it passes from print to persons, producing violence. In *The history of Jacobinism, its crimes, cruelties and perfidies* (1795) Playfair describes the causes of mob violence: ‘The enthusiasm inspired by continually speaking and acting in a common cause . . . gives a sort of electric shock that is communicated from one eye to another, that raises the man

above himself in courage, and sinks him below the brute in savageness.⁷⁴ Again the threat of electrical communication lies in its physical effects and, Playfair implies, its physical cause. The ‘electric’ communication brings out an instinctive savagery, and destabilises the distinction between human and animal. While for Darwin this instinctive electrical action is no cause for alarm, for Playfair it proves the brutality of revolutionary unrest.

Thomas Paine’s *The Rights of Man* appeared in two parts in 1791 and 1792, and its astonishing influence intensifies the connection between print communication, mob violence and electrical phenomena in conservative writings in Britain and in America.⁷⁵ John Quincy Adams composes a series of letters to the *Boston Sentinel* signed ‘Publicola’ in June and July 1791, criticising Thomas Jefferson’s support for Paine. In doing so, he engages with other responses to Paine in Britain, and the broader debate over revolutionary principles.⁷⁶ In Letter V, Adams analyses the ‘mob’ in Britain and in France and declares ‘it is the happiness of Americans scarcely to be able to form an idea’ of it. For Adams, members of the mob ‘cannot be considered as free agents, and are therefore neither the subjects of praise or of blame’.⁷⁷ He condemns those who incite them because

once they are put in motion, they soon get beyond all restraint and controul. The rights of man to life, liberty, and property, oppose but a feeble barrier to them; the beauteous face of nature, and the elegant refinements of art, the hoary head of wisdom, and the enchanting smile of beauty, are all equally liable to become obnoxious to them; and as all their power consists in destruction, whatever meets with their displeasure must be devoted to ruin.⁷⁸

The mob’s destructive power is such, declares Adams, that it should never be used as an instrument of government. The revolutionaries in France have acted too quickly to realise this.

Such . . . indeed, was the situation of the French National Assembly when they directed the electrical fluid of this popular phraenzy against the ancient fabric of their monarchy. They justly thought that no price could purchase too dearly the fall of arbitrary power in an individual; but perhaps even *they* were not aware of the consequences which might follow of committing the existence of a kingdom to the custody of a lawless and desperate rabble.⁷⁹

Though Adams has some sympathy for the French, his use of electrical language demonstrates his phobia of collective action. In describing such

action as an ‘electrical fluid’, Adams evokes the violence of this ‘popular phraenzy’, its instantaneous spread, and the impossibility of destroying what he figures as an instinctive physical phenomenon.

But Adams’s condemnation of this ‘electrical fluid’ has further implications, which perhaps explain the frequency with which conservative writers use electrical images. The language of electricity often signals the uncontrollable qualities of print transmission and of collective behaviour, but the afterlife of Adams’s ‘electric fluid’ image demonstrates that the metaphor itself has some of the proliferative qualities of electricity. Adams’s image reappears in a 1793 pamphlet *The Antigallican; or, strictures on the present form of government established in France*, published anonymously by Edward Long, whose previous works were travel accounts of Jamaica. Long turns to events in France, and openly plagiarises other published works. The opening pages of his pamphlet cite a range of sources, including Adams, but Long’s footnotes become increasingly scarce, and he gives no suggestion of his source when he declares of the mob:

When once put in motion, they soon get beyond all restraint and controul; the rights of men to life, liberty, and property, oppose but a feeble barrier to them. The beauteous face of nature, and the elegant refinements of art, the repositories of wisdom, the sanctuaries of religion, are all equally liable to become obnoxious to them. Whatever meets with their displeasure must be devoted to ruin. When the National Assembly directed the electrical fluid of this popular phraenzy against the ancient fabric of their Monarchy, its Members thought they could not purchase too dearly the fall of arbitrary power, but they were not aware of the fatal consequences of committing the existence of an Empire to the custody of a lawless and desperate rabble.⁸⁰

This is a close appropriation of Adams’s letters, though at the close of the passage Long uses more extreme language to describe collective action. His electric image takes on a more phobic character than Adams’s, but also seems to model the process it describes. Long’s pamphlet gestures towards the malleable, uncontrollable communicative properties of print. With its patchwork of the writings of others, it defies any straightforward attribution of authorship, and Long’s inflammatory rhetoric accentuates the text’s catalytic potential. Even in its account of the mob, the subject to which it obsessively returns, the pamphlet enacts the uncontrollable effects of communicative acts in print or in person. Long encounters a problem with which, as Kevin Gilmartin notes, many conservative writers have to

contend. ‘The paradox of loyalist activism, deeply embedded in its discursive organization, involves the effort to combat radicalism though a set of political strategies . . . with evident radical association.’⁸¹ Here Long enacts the nightmare of instinctive, uncontrollable communication.

Long’s pamphlet is opportunistic in its political and ethical stance. He uses phobic language to describe the ‘mob’, noting in an echo of Burke that ‘this sovereign people . . . may be truly denominated a *swinish multitude*. But all the lower ranks of mankind, even when the laws against immorality are put into execution, are *swinish* in this respect.’⁸² However, his account of a loyalist mob’s attack on Thomas Hardy of the London Corresponding Society is sanguine:

These rapacious notions having been propagated from France to England, and inflammatory writings and hand-bills having been distributed to the lower classes of the people to incite them to plunder, the levelling Shoemaker . . . had his own house broken open in the middle of the night by a troop composed of innocent and infatuated persons, and lawless ruffians; for such are always ready to take advantage of confusion.⁸³

For Long, acts of violence are not motivated by political principle but rather by the ‘swinish’ nature of all working people, catalysed by ‘inflammatory writings and hand-bills’. His pamphlet suggests that the ‘electrical fluid’ is a peculiarly apt metaphor for ‘popular phraenzy’; it is powerful, but instinctive and irrational and therefore politically indiscriminate.

Long’s pamphlet echoes reports of the loyalist riots that destroyed Priestley’s home and laboratory in Birmingham in 1792. *The Times* reports that, ‘a kind of electrical patriotism animated [the rioters] to instant vengeance’.⁸⁴ Electricity is again the catalyst of collective action, but here it activates reactionary violence. *The Times*’s use of this metaphor seems to refer to Priestley’s electrical researches and his polemical use of electrical language, for instance his 1774 remark that ‘the English hierarchy (if there be anything unsound in its constitution) has equal reason to tremble even at an air pump, or an electrical machine’.⁸⁵ The rioters too focus on Priestley’s electrical work; as he notes, ‘I afterwards learned that much pains was taken . . . to get fire from my large electrical machine, which stood in the library.’⁸⁶ *The Times* also suggests the complex connection between written communication and violence, condemning an ‘inflammatory bill in Doctor Priestley’s handwriting’ found at his house, but denying accusations that an ‘inflammatory hand-bill’ stimulated the rioters themselves.⁸⁷ But its electrical image

suggests the alarmingly indiscriminate effects of both collective action and electrical communication. ‘Electrical patriotism’ is used in a different context in 1793 by Arthur Young, in his pamphlet *The example of France a warning to Britain*, which signalled his abandonment of his early support for the Revolution.⁸⁸ Young praises the establishment of conservative associations, declaring how the ‘real friend to his country’ must ‘rejoice to see this electric stroke of true patriotism spread with vital energy through the empire’.⁸⁹ Young reverses the claims of fellow critics of the Revolution, suggesting that counter-revolutionary ‘vital energy’ too can be communicated with electrical swiftness. But he cannot distinguish this electrical ‘patriotism’ from the violence of the Birmingham rioters. Both examples of electrical ‘vital energy’ emphasise the physical causes of such communication.

In 1794 and 1795, counter-revolutionary uses of electrical imagery alter again. The ‘electric fluid’ is less often evoked to explain the actions of the ‘mob’. Instead it articulates anxieties about the operation of a more fundamental, occult, even monstrous ‘Revolutionary principle’ which also seems to owe its origin to the vital qualities of electricity. Like Burke’s *Reflections, Considerations on the present internal and external condition of France* (1794), by the retired colonial administrator and newspaper polemicist Maurice Morgann, argues for continuity between the physical and ‘moral’ world.⁹⁰ Morgann models his assertion of these ‘horrid’ connections on Milton’s *Paradise Lost*:

Milton has given us a sort of physical anarchy in his infernal world . . . not without reference . . . to a moral anarchy, for between physics and morals there is so close an analogy that they seem reciprocally to reflect each other . . . We are, therefore, to see how this *monster* was produced in France, how it is organised, and on what principles it may *endure*.⁹¹

Morgann is self-conscious about his use of figurative language; he suggests that metaphor is the only means through which this revolutionary monstrosity can be articulated and condemned. The ‘*monster*’ is not the mob, but the obscure vital spirit, through which revolutionary principles are communicated, and the body of a revolutionary state given coherence. In the early stages of the revolution, Morgann asserts:

a chain of political clubs, like an eruptive disease, embraced the whole country, and became in effect the jointed bones and vertebrae of the new-born monster. I speak in figure for the sake both of brevity and force, but the

reader will look through the figure to the thing itself: – the *head*... of this articulated monster was in Paris, under the name of the Jacobin Club, but the *body* was extended every where, and after a thousand involutions... terminated in a Parisian mob.⁹²

Morgann implies that his ‘figure’ might obscure the meaning of the ‘thing’ itself, but adopts it nonetheless for ‘brevity and force’. Figurative language allows him to make visible what was formerly only occult, to characterise and to condemn the properties of the revolutionary state. Like Long and Playfair, Morgann is concerned with the communication of revolutionary principles, and he too uses an electrical image to articulate its threat:

the *word* was given by the Parisian Club, and passed freely through every link like an electrical flame: on the various articulations of this monster grew the *revolutionary force*... and thus a regular circulation of evil has pervaded the *whole*, and rendered the monster through all its involutions strictly *one*.⁹³

For Morgann, this electrical communication operates internally within the monstrous body of the revolutionary state; it enables communication between the various parts and ensures its internal coherence and vital powers. Morgann again defends his use of metaphor: ‘it may be asked, if I mean to form a system upon figure – by no means; but I have a right to explain as I can’.⁹⁴ Figurative language is the best means to account for revolutionary principles because it makes the occult visible and thus subject to interrogation. But electricity is never a stable object of attack. Like other pamphleteers, Morgann finds that his figurative connection between revolutionary principles and electrical vital energies intensifies the threats that he describes.

‘Farther Reflections, submitted to the Consideration of the Combined Powers’ (1794), by John Bowles, contributor to the *Anti-Jacobin Review* and founder of the Crown and Anchor Society, also presents the Revolution as the effect of an abstract ‘Revolutionary principle’. For Bowles the ‘real enemy... is not the French Nation – not even the French Republic – but the French Revolution... a Revolution, which, if it exist much longer, will spread the Revolutionary Wildfire over the earth’.⁹⁵ Bowles declares the cause of the Revolution is an unprecedented and obscure communicative principle, and characterises this principle as electrical: ‘It acts by a subtle principle, which, like the electrical fluid, can

penetrate every-where, dissolve the firmest and closest ties, and reduce society . . . into a state of fusion.⁹⁶ Bowles gestures not only to the occult communicative force that unites the nation, but also to the power of revolutionary principles to fissure longstanding traditions.

The tendency of this Revolution is universal . . . It tends every-where to destroy, not only the bonds and attachments which constitute the social union in every body politic, but even those national characteristics . . . so conducive to their prosperity. The disorganizing principle of this Revolution tends, in short, to subvert all order and society; to annihilate all distinctions, great and small, which are essential to the harmony of the world . . . [and] to reduce the world to a state of chaotic equality.⁹⁷

In his references to ‘bonds and attachments’ and his characterisation of revolutionary energies as a ‘disorganizing principle’, Bowles echoes Burke’s critique of revolutionary abstraction in the *Reflections*.⁹⁸ But by making his ‘unknown attractive power’ electrical, Bowles emphasises its unknowable, infinite effects.

The connections between Bowles’s and Burke’s writings are unsurprising: Bowles sent Burke copies of his pamphlets on at least two occasions, and Burke responded in February 1796 to praise ‘Farther Reflections’, noting the coincidence between its arguments and those of his own work in progress, *Letters on a Regicide Peace*: ‘You have gone to the bottom of the subject, with intelligence, perspicuity, force and Eloquence. I really do not know, that I have done any thing more than to follow in your track.’⁹⁹ This is intense politeness from Burke, but their accounts of the ‘Regicide power’ are indeed similar.¹⁰⁰ In the *Letters on a Regicide Peace* Burke uses images of the ‘electric fluid’ to describe the unprecedented nature of events in France. For Burke electricity is a means to account for the behaviour of the revolutionary mob, the function of the press, and the operation of the more abstract, perhaps more occult, revolutionary ‘principle’.

Burke famously used figurative language to sustain political arguments. In March 1796, while he was composing the *Letters on a Regicide Peace*, the *Critical Review* wrote of his *Letter to a Noble Lord*: ‘in pursuit of a metaphor, he loses sight of all regard to his hearers or readers’, concluding that figurative excess is a symptom of Burke’s inexact thinking.¹⁰¹ But Burke begins the *Letters* with a stern account of the limited utility of figurative language in political discourse, which challenges not only

Morgann's account of the continuity between 'physical' and 'moral' phenomena, but also his own arguments in the *Reflections*.

Parallels of this sort rather furnish similitudes to illustrate or to adorn, than supply analogies from whence to reason. The objects which are attempted to be forced into an analogy are not found in the same classes of existence. Individuals are physical beings, subject to laws universal and invariable . . . But commonwealths are not physical but moral essences . . . There is not in the physical order (with which they do not appear to hold any assignable connexion) a distinct cause by which any of those fabrics must necessarily grow, flourish, or decay; nor . . . does the moral world produce any thing more determinate on that subject, than what may serve as an amusement . . . for speculative men.¹⁰²

Unlike Darwin, Burke polices the distinction between philosophical analogy and poetic figure. But he seems unable to resist the search for a 'distinct cause' of political events in France and Britain, and their unprecedented nature necessitates figurative expression. In adopting such a course, Burke is not guilty of the *Critical Review's* charge of superficial 'affectation of style'.¹⁰³ His use of figurative language in the *Letters* attempts to diagnose the threat of the 'Revolutionary principle'.

Burke repeatedly emphasises that events in France are unprecedented.¹⁰⁴ This revolutionary process is extremely difficult to oppose, because it is an absence, which destroys existing institutions and values:

We are in a war of a peculiar nature . . . We are at war with a system, which by its essence, is inimical to all other Governments . . . It is with an *armed doctrine* that we are at war. It has, by its essence a faction of opinion, and of interest, and of enthusiasm, in every country. To us it is a Colossus which bestrides our channel. It has one foot on a foreign shore, thither upon the British soil.¹⁰⁵

Burke names the qualities of the 'Revolutionary principle' in France, but stresses the intense difficulty of engaging with this abstracted enemy, a 'system', a 'doctrine' rather than a nation. This 'system' operates through communication of opinion, a communication that has already leapt the Channel to reside in 'British soil'. Much of Burke's text is concerned with the vitalising effects of this principle on British reformists, and the sources of internal corruption that have enabled it. Its occult qualities lead him, like Morgann, to adopt a language of monstrosity: 'My ideas and principles have led me . . . to encounter France not as a State, but as a Faction . . . The faction

is the evil spirit that possesses the body of France . . . It is that spirit which inspires them to a new, a pernicious, and desolating activity.’¹⁰⁶ Burke points to the universal reach, as well as the occult origins and gruesome effects of the ‘faction’, which ‘is not local or territorial. It is a general evil. Where it least appears in action, it is still full of life. In its sleep it recruits its strength, and prepares its exertion.’¹⁰⁷ The most unnerving quality of the ‘Revolutionary principle’ is its resistance to classification, and its capacity to manifest itself anywhere and reveal the ‘corruptions of our common nature’.¹⁰⁸ Burke gestures to the gothic aspects of electrical communication suggested by Darwin, making electric vitality monstrous.

Burke returns repeatedly to the dangers of proximity to the source of the ‘Revolutionary principle’.¹⁰⁹ His self-appointed task is to alert the British government to these dangers.¹¹⁰ At times the British side of the ‘faction’ manifests the most virulent threat of all, as British agitators embody the characteristics of the revolutionary principle:

These, by their spirit of intrigue, and by their restless agitating activity, are of a force far superior to their numbers . . . By passing from place to place with a velocity incredible, and diversifying their character and description, they are capable of mimicking the general voice . . . The spirit of enterprise gives to this description the full use of all their native energies.¹¹¹

Like the ‘Revolutionary principle’, the communicative activities of the ‘seditious English’ are unnerving because they operate at high speed, and are impossible to quantify. But most worryingly, their success points to innate corruption in British society, which will be only intensified by the government’s proposals for peace.

It is in the nature of these eruptive diseases in the State to sink in by fits, and re-appear. But the fuel of the malady remains; and . . . is not in the smallest degree mitigated in its malignity, though it waits the favourable moment of a freer communication with the source of the Regicide to exert and to increase its force.¹¹²

Burke again explores the ‘fuel of the malady’. Like Morgann, he moves between a conception of this principle as pathology, and as vitality. But so obscure is this source that Burke resorts to a language of monstrosity, abandoning any distrust of figurative expression, and seizing on metaphor as a means of articulating its threat.

In the *Letters* Burke describes ‘Regicide France’ as ‘the mother of monsters, more prolifick than the country of old called *ferax monstrorum*’.¹¹³ Its monstrous qualities are the vitalising, obscure and communicative nature of the ‘Revolutionary principle’. In the fourth letter, Burke employs monstrous imagery to persuade readers who might doubt him:

Five years has this Monster continued whole and entire in all its members. Far from falling into a division within itself, it is augmented by tremendous additions. We cannot bear to look that frightful form in the face as it is and in its own actual shape . . . Talk not to me of what swarms of Republicks may come from this carcass! It is no carcass. Now, now, whilst we are talking, it is full of life and action.¹¹⁴

Revolutionary principles vitalise the carcass of the state. Burke exhorts his reader to look the ‘frightful form in the face’:

[O]ut of the tomb of the murdered Monarchy in France, has arisen a vast, tremendous, unformed spectre, in a far more terrific guise than any which ever yet have overpowered the imagination and subdued the fortitude of man . . . that hideous phantom overpowered those who could not believe it was possible she could at all exist.¹¹⁵

In contrast to his claim that the ‘physical’ and ‘moral’ entities cannot be united by analogy, Burke declares, ‘the constitution of any political being, as well as that of any physical being, ought to be known, before one can venture to say what . . . is the proper means for its power’.¹¹⁶ By visualising the ‘frightful form’ of the ‘Revolutionary principle’, Burke suggests, we can analyse it.¹¹⁷ In the fourth letter he declares that this process is only possible through analogy:

Here we have, formed, a new, unlooked-for, monstrous, heterogeneous alliance; a double-natured Monster . . . There is . . . nothing short of the Hieroglyphick Monsters of Aegypt, Dog in Head and Man in Body, that can give an idea of it. None of these things can subsist in nature; so at least it is thought. But the moral world admits Monsters which the physical rejects.¹¹⁸

Far from rejecting the use of figurative reasoning, Burke uses metaphorical language in the *Letters* to identify the occult horrors of the ‘Regicide State’ and their vitalising powers.

Though images of monstrosity enable Burke to articulate the threat of the ‘Revolutionary principle’, such language cannot account for the ‘pestilential contagion’ of its communicative properties.¹¹⁹ Images of contagion go some way towards describing such communication, but cannot explain the way in which these principles correspond with internal corruption in British politics and ‘morals’. Burke turns to another figure to articulate this danger, and perhaps account for the occult principles of the ‘Regicide state’. This is the language of electricity.

Burke uses explicit electrical metaphors at only two points in the *Letters*, but these images encapsulate his account of the threat of revolutionary France, as electricity is so imperfectly defined that it stands for the equally obscure ‘Revolutionary principle’. In the first letter, Burke describes the effect on British ambassadors of an audience with the ‘Regicide presence’. He declares that

These ambassadors may easily return as good courtiers as they went; but can they ever return from that degrading residence, loyal and faithful subjects; or with any . . . true attachment to the constitution, religion, or laws of their country? There is great danger that they who enter smiling into this Trophonian Cave, will come out of it sad and serious conspirators; and such will continue as long as they live. They will become true conductors of contagion to every country which has had the misfortune to send them to the source of that electricity.¹²⁰

Burke employs a language of electric contagion, citing France as the ‘source’ of that electric fluid. Contact with the ‘Regicide presence’ will affect the ambassadors like the cave of Trophonius, which affected ‘those who entered with such awe that they never smiled again’.¹²¹ But in addition the ambassadors will act as ‘conductors’ of this electricity, which will communicate revolutionary principles and denature customary modes of ‘true attachment to the constitution, religion, or laws of their country’. Electricity for Burke like Bowles represents the fissuring effects of the ‘Revolutionary principle’, but these destructive properties are inseparable from the tendency of the electrical force to correspond with and vitalise an internal corruption in individuals and collectives.

In the second letter, Burke uses an electric image to emphasise the communicative properties of the ‘Revolutionary principle’. Like Playfair and Long, he makes electricity an image of the press in the first moments of the Revolution, but unlike those accounts, Burke evokes electricity as a monstrous

vitalising force. The revolutionary principle is a destructive power, through which ‘the chain of subordination, even in cabal and sedition, was broken in its most important links . . . Other interests were formed, other dependencies, other connections, other communications.’¹²² These pervasive ‘communications’, Burke declares, made political upheaval inevitable:

The correspondence of the monied and the mercantile world, the literary intercourse of academies but, above all, the press . . . made a kind of electric communication every where. The press, in reality, has made every Government, in its spirit, almost democrattick. Without the great, the first movements in this revolution could not . . . have been given. But the spirit of ambition, now for the first time connected with the spirit of speculation, was not to be restrained at will. There was no longer any means of arresting a principle in its course.¹²³

Through this electrical image Burke can account for the communicative qualities of revolutionary doctrine, and the velocity of its transmission. But importantly, it is not a means of explaining such phenomena. Like the ‘Revolutionary principle’ this electric ‘principle’ is inexplicable, occult, even monstrous. The electrical metaphors that Burke employs in the *Reflections* and *Letters on a Regicide Peace* do not explain French revolutionary principles. Instead, they make visible the occult properties of those principles, and emphasise their threat.¹²⁴ John Courtney’s account in 1790 of the revolutionary ‘electric returning stroke’, ironic though it may be, proves remarkably prescient. In the early 1790s the language of electricity provides a language through which Burke can condemn French revolutionary phenomena, from the violence of the mob and the operation of the press, to the monstrous, occult principles of revolution, but his figures and those of his contemporaries seem to resist the control of their authors.

4 REFORM AND PROGRESS

Conservative commentators find that the electrical language they employ to condemn revolutionary energies has a tendency to shift meaning, to the extent that the same language can be used to celebrate the actions of ‘patriotic’ mobs. Reformist writers in Britain also use electrical imagery to describe political phenomena, and in many cases simply reverse the arguments of counter-revolutionaries, and celebrate the rapid, wide-ranging and vitalising effects of ‘electric communication every where’. But these celebrations too are shadowed by the instability of electrical imagery.

Celebrations of revolutionary communication as enlightened progress are shadowed by the obscure provenance, and gothic implications of electric communication. While reformers find utility in the vitalising language earlier employed by Merry and Robinson, electricity's association with physiological processes complicates any claims that it is a medium of rational discourse. The use of electrical language by reformist writers demonstrates the risks as well as the positive power of the figurative connection between electrical communication and political activity. I end this chapter, however, with an account of John Thelwall's sustained engagement with electrical discourse, which demonstrates that for some reformers, the unstable aspects of electric vitality and communication represent the best qualities of radical political engagement.

Throughout the 1790s, electrical images describe and celebrate the press as a communicative medium. But such celebrations illustrate a divide among reformist writers over whether the press should be celebrated as a communicative medium regardless of what is being communicated.¹²⁵ Mee uses the phrase 'print magic' to describe reformist faith 'that print could liberate mankind just by bringing ideas into printed circulation', though he notes reformers' careful attention to the 'constraints' on such circulation, and indeed the limits of such 'magic'.¹²⁶ Mee notes that when radical writers evoked 'print magic', they 'often used the trope of an electric immediacy of communication'.¹²⁷ Many reformers use electrical images of communication in this way, but the prospect of rapid and unlimited communication is not always positive, and electrical imagery often occurs at moments of discomfort about the proliferation of print. In her 1790 *Address to the opposers of the repeal of the Corporation and Test Acts* Anna Laetitia Barbauld ironically notes the 'compliment' of the hysterical response to dissenters' campaigns for increased rights. 'How quick the alarm has been taken, and sounded from the Church to the Senate, and from the press to the people; while fears and forebodings were communicated like an electric shock!'¹²⁸ Barbauld's account of this 'electric' communication ironically echoes counter-revolutionary attacks on the proliferation of reformist ideas. But though the irony is clear, Barbauld does not challenge this account of electric communication, and makes no connection between the progressive nature of dissenters' claims and an 'electric' medium.

Other reformers make strenuous attempts to assign 'electric communication' a positive political valence beyond the speed of its transmission, and to associate images of electric communication with narratives of

progress and enlightenment. The London Revolution Society, formed to celebrate the ideals of the Glorious Revolution but soon associated by its opponents with the excesses of the French, is a target of Burke's attacks in the *Reflections* for what he sees as its clandestine correspondence with the National Assembly in Paris.¹²⁹ In response, Society members offer a transparent account of its dealings with the National Assembly, publishing its correspondence in full in 1792. The Society uses this publication to celebrate the political effects of correspondence more broadly. A letter of 13 March 1791 signed by the secretary Benjamin Cooper uses the image of revolutionary communication through the press as an 'electrical stroke', but associates this 'stroke' not with shock or pain but with enlightenment: 'there is a degree of oppression which human nature cannot bear – the light of truth breaking out, by communicating sentiments by means of the press, brought on a *crisis* like an electrical stroke, not to be resisted but by a contact spread through all ranks'.¹³⁰ Cooper's letter echoes conservative attacks on revolutionary communication, but inverts their terms. The press is the source of an electric communication of reformist 'sentiments', but in this celebration electricity is also an emblem of the enlightened progress that such communication will enable. The Revolution Society's correspondents in France respond in a letter of 9 June 1791, writing that '*The Rights of Man*, discovered under the dark dungeon of the Bastille, will become the basis of the *universal* confederation; and those decrees, works of wisdom and reason, will be the electric fire which will communicate to the nations the commotions of French patriotism'.¹³¹ In this letter it is writing, the 'decrees' of the *Rights of Man*, that constitutes the salutary 'electric fire'. Both letters, however, show that electrical communication cannot be straightforwardly associated with enlightened reason, as both British and French correspondents note that it also produces 'crisis' and 'commotion'.

The mixed implications of electrical communication through the press are exploited in reformist writings. Rather than make Burke's 'electrick communication every where' either simply a pernicious contagion, or a medium of enlightenment, reformers make the case for the vitalising effects of revolutionary discourse.¹³² An anonymous correspondent to the *Public Advertiser* of 8 June 1790 describes to the prime minister William Pitt the differences between Britain and France:

The two countries have almost changed their fundamental principles... one has eagerly adopted what the other has hastily relinquished... [T]he

doctrine is novel and unprecedented in former wars; publicity is the vital principle, the electric fire, which pervades and animates the energy and exertions of a free country; secrecy and mysteriousness are the characteristics of despotic governments.¹³³

The ‘publicity’ of communication through the press is, for this correspondent, the electric ‘vital principle’ of revolutionary activity. Electricity is the emblem of enlightened progress, but it is compared with an obscure physiological process, the ‘vital principle . . . which pervades and animates the energy and exertions of a free country’. As in Darwin’s writings, there are no limits to the effects of this mysterious, wide-ranging power. But this turn to physiological language complicates the association of electrical communication with enlightenment, and even evokes the gothic obscurity emphasised by Burke.

Later attempts to fix electrical communication and associate it with reason also prove fraught. Samuel Taylor Coleridge in his 1795 political lecture in protest at the Pitt government’s Seditious Meetings and Treasonable Practices Bill celebrates the reformist activity killed off by the legislation: ‘By the operation of Lord Grenville’s Bill, the press is made useless. Every town is insulated: the vast conductors are destroyed by which the electric fluid of truth was conveyed from man to man, and nation to nation.’¹³⁴ Electric communication retains its diffusive aspect, but medium and content seem combined in Coleridge’s nostalgic account producing a pure ‘truth’ which is now lost. Coleridge’s friend Robert Southey uses the same image in his drama *Wat Tyler*, written in 1794 but unpublished until 1817. In the final act, the rebel preacher John Ball makes his last speech before being executed for treason. Ball laments the injustices of inequality, and declares:

And there will be a time when this great truth
Shall be confess’d—be felt by all mankind.
The electric truth shall run from man to man,
And the blood-cemented pyramid of greatness
Shall fall before the flash!¹³⁵

Southey does not worry about the anachronism of this image of contemporary science in his fourteenth-century drama. His account of radical communication echoes Darwin’s praise of Franklin, and the anachronism even serves Southey’s aim to emphasise parallels between the Peasants’ Revolt and conditions in contemporary Britain. Like Coleridge, Southey

makes ‘electric truth’ a phenomenon that unites medium and content. For Fulford, ‘electricity puts “truth” into action’ for Southey; it is a means of communication, an intuition of enlightenment, and a catalyst of political action.¹³⁶ But the multiple valence of Southey’s image complicates the work of his text. While ‘electric truth’ itself has mixed connotations, Ball ends his speech by stressing electricity’s capacity to catalyse not only ‘truth’ but also violence. As Fulford notes, Southey knew the debates about physiological electricity, noting in a letter to Humphry Davy that ‘the galvanic fluid stimulated to motion . . . is the same as the nervous fluid’.¹³⁷ But perhaps as a result, his image of ‘electrical truth’ in *Wat Tyler* cannot stand simply as an emblem of enlightened political progress, but is shadowed by its association with physical communication and violence. Coleridge and Southey’s use of electricity does not evoke its vital, animating properties which prove useful to contemporaries like Darwin. In the absence of this vitalising language, the electrical communication of ‘truth’ shades into more pernicious forms of transmission.

Another group of reformist writers suggest that the communication of both passions and ideas might be described in electrical terms. Mary Wollstonecraft, Mary Hays and William Godwin conduct a series of responses both to conservative condemnations of pernicious communication, and also to Godwin’s own claims in the first edition of *Political Justice* in 1793, which are echoed in Coleridge and Southey’s electrical ‘truth’. For Godwin in 1793, ‘if there be such a thing as truth, it must infallibly be struck out by the collision of mind with mind’.¹³⁸ The concept of communication is vital to Godwin’s account of mental development and political progress, but it is produced through ‘reading and conversation’ in which reason takes precedence.¹³⁹ Godwin condemns the communication of ideas and emotions in political associations, declaring: ‘there is nothing more barbarous, cruel and blood-thirsty than the triumph of a mob’.¹⁴⁰ The collective communication of ideas through electrical transmission, which so many reformers celebrate, seems anathema to Godwin’s account. But Wollstonecraft, Hays, and Godwin himself, demonstrate that electrical communication might be the medium of both emotion and rational discourse. They sustain a distrust of collective communication, but use a language of electricity to investigate in a philosophical mode the possibilities of emotional and intellectual exchange.

In her *Vindication of the Rights of Woman* (1792), Wollstonecraft generally upholds the supremacy of reason over the passions, and notes that our thoughts and character are the result of the gradual accumulation of

experience and the association of ideas.¹⁴¹ But there is a certain class of idea, which cannot be explained according to such models: ‘that quick perception of truth, which is so intuitive that it baffles research, and makes us at a loss to determine whether it is reminiscence or ratiocination, lost sight of in its celerity, that opens up the dark cloud’.¹⁴² The origin of such rapid insights is obscure to the extent that it ‘baffles research’, but nonetheless they produce the finest aspects of human thought. Wollstonecraft declares:

Over those instantaneous associations we have little power; for . . . the raw materials will, in some degree, arrange themselves. The understanding . . . may keep us from going out of drawing when we group our thoughts, or transcribe from imagination the warm sketches of fancy; but the animal spirits, the individual character, give the colouring. Over this subtle electric fluid,* how little power do we possess, and over it how little power can reason attain! These fine intractable spirits appear to be the essence of genius, and beaming in its eagle eye, produce in the most eminent degree the happy energy of associating thoughts that surprise, delight and instruct. These are the glowing minds that concentrate pictures for their fellow creatures; forcing them to view with interest the objects reflected from the impassioned imagination, which must be passed over in nature.¹⁴³

Wollstonecraft makes a complex series of claims, which demonstrate the inadequacy of reason to account for what she terms in *The Wrongs of Woman* ‘the electric spark of genius’.¹⁴⁴ She extends a painting metaphor to note that while reason can sketch the lines, this creative force gives the colour. Reaching for an image to describe this phenomenon, Wollstonecraft evokes the ‘subtile electric fluid’. She connects this fluid not with images of electrical enlightenment but rather with physiological models of the ‘animal spirits’; this communication is obscure and physical. And importantly, it is not an individualised phenomenon. Wollstonecraft makes her electrical force communicable and vitalising; it awakens the awareness of the creator’s ‘fellow creatures’ to the power of genius.

Wollstonecraft’s celebration of this ‘subtile electric fluid’ continues in a footnote to this passage, where she speculates about its nature, and engages with contemporary accounts of matter, and of the soul:

*I have sometimes, when inclined to laugh at materialists, asked whether, as the most powerful effects in nature are apparently produced by fluids, the magnetic, etc., the passions might not be fine volatile fluids that embraced humanity, keeping the more refractory elementary parts together – or

whether they were simply a liquid fire that pervaded the more sluggish materials, giving them light and heat?¹⁴⁵

Though Wollstonecraft does not share the materialist views of Priestley or Godwin, she considers whether the ‘subtile electric fluid’ which pervades the body and mind might make the ‘passions’ themselves a ‘fine volatile’ but material fluid. But Wollstonecraft’s suggestion morphs into a hint that this fluid is immaterial, yet animating, giving ‘sluggish materials’ their ‘light and heat’. Wollstonecraft suggests that even if these phenomena are unknowable, their effect is tangible and social. Such physiological electrical communication is far from enlightened reason, but it is creative, animating, and has the power to unify diverse social and political actors.

Wollstonecraft’s ‘subtile electric fluid’ is an extended metaphor for mental processes, but she is able to assign it such productive complexity because of her understanding of debates over the nature of electricity. In doing so, she comes close to the speculations of Merry and Robinson, but these electrical passions work in tandem with, rather than at the expense of, reason. Hays too uses electrical language to articulate the difference between mindless passions, and reasoned love in her *Letters and Essays* (1793). In a narrative essay detailing the chilling effects of female education and the importance of rational love and faith, Hays describes the meeting of the fictional Melville and Cecilia:

Those emotions which we feel at the first sight of an object that pleases us, cannot perhaps with propriety be called love. . . [H]ow very unworthy are those transient sensations of passion, which are sometimes excited in the giddy of both sexes . . . It is certain there is in some minds . . . a congeniality – were I not a materialist, I should say a recognition of souls, which flows in the features and moves the heart with a sort of electrical sympathy. Many will not understand me, but this I cannot help.¹⁴⁶

For Hays like Wollstonecraft, electricity accounts for the connection between individuals. In contrast to Wollstonecraft, she upholds materialist views; she declares in the same volume that she knows ‘not how to separate my ideas of a spirit, from the organs on which it acts’.¹⁴⁷ But here as in the *Vindication* electricity represents communication in an uncertain state between the material and the spiritual, its animating powers resulting from unknown causes. In Hays’s novel *Memoirs of Emma Courtney* (1796) too, electrical language is a means of

distinguishing reasoned feeling from mindless passions. Emma writes to the object of her unrequited love Augustus Harley:

The genuine effusions of the heart and mind are easily distinguished . . . from the vain ostentation of sentiment . . . which, causing no emotion, communicates none – Oh! How unlike the energetic sympathies of truth and feeling, darting from mind to mind, enlightening, warming, with electrical rapidity!¹⁴⁸

Hays describes a domestic, individualised exchange of feeling but her electrical metaphor emphasises the physiological basis and the collective potential reach of such communication.

Even Godwin, in his revisions to *Political Justice*, acknowledges the importance of unregulated, rapid communication. He notes in 1798:

Even knowledge and the enlargement of the intellect, are poor when unmixed with the sentiments of benevolence and sympathy. Emotions are scarcely ever thrilling and electrical without something of social feeling. When the mind expands in works of taste and imagination, it will usually be found that there is something moral in the cause which gives birth to this expansion; and science and abstraction will soon become cold, unless they derive new attractions from ideas of society.¹⁴⁹

Here the ‘electrical’ qualities of emotional communication do not make it a pernicious contagion, as Godwin suggested in the first edition of *Political Justice*. Rather, the electrical communication of emotion, a ‘thrilling’ physiological process, produces an understanding of the social quality of such feeling, and its associated ‘moral’ effects. Wollstonecraft, Hays and Godwin thus celebrate electrical communication as the medium for reasoned connections between individuals, while foregrounding its mysterious physiological status.

While Godwin, Wollstonecraft and Hays celebrate the social qualities of electric communication, their accounts focus on an intimate exchange of feeling, and struggle to praise mass communication in a crowd or in the press.¹⁵⁰ John Thelwall in contrast uses the language of electricity to answer conservative assumptions that mass communication is a form of contagion. Electrical language pervades Thelwall’s literary and political writings in the 1790s, and in contrast to many reformers, he engages closely with accounts of its physiological operation. His medical training, acquired in the audience of medical lectures and as a member of the Physical Society at Guy’s

Hospital, enables him to celebrate the salutary effects of electricity on the body.¹⁵¹ Thelwall's uses of the image of the vital electric spark in his political writings are an important example of the radical implications of such imagery identified by recent critics. But the detail of Thelwall's engagement with electrical science is unusual, and even he struggles to make electric communication a uniformly positive symbol of his political practice. Thelwall's account of his oratory in particular demonstrates the difficulties of co-opting electrical imagery for a radical cause.

In one of his first published works, the *Essay towards a definition of Animal Vitality* (1793), Thelwall engages in detail with contemporary claims for an electrical vital spirit. John Hunter had claimed in his *Lectures on the Principles of Surgery* that though the conditions for life inhere in the 'modification' of organic matter, and though 'every individual particle of the animal matter . . . is possessed of life', life itself 'appears to be something superadded to this peculiar modification of matter', which might be found in the blood.¹⁵² Thelwall disagrees, declaring that according to 'the simple principles of materialism', Hunter's claims for a vital spirit 'superadded' to matter must be false.¹⁵³ But Thelwall's own account of the conditions required for life in the *Essay* demonstrates the enduring obscurity, as well as the political significance, of claims for an electrical vital spirit. Thelwall's text is a provocative gesture to the medical and political establishment, but at times he comes close to the views of Hunter, demonstrating the difficulty of maintaining a consistent set of claims about electrical vitality.

In his opening dedication, Thelwall presents himself as a 'young theorist' rather than an experimenter, whose claims might be dismissed as 'speculations'.¹⁵⁴ But he insists his lack of empirical expertise is no barrier; all analyses of the vital spirit must be speculative, since they cannot be experimentally proven. Given 'the limits of our present knowledge', the 'Anatomical Physiologist himself is frequently left to wander in the regions of conjecture', and 'analogy . . . is often called on to supply the place of demonstration'.¹⁵⁵ Thelwall advocates such 'conjecture'; he notes that '*candour of judgement*' will stimulate 'ardour' and 'keenness of investigation'.¹⁵⁶ For Thelwall here as in his political writings, unresolved questions are the greatest stimulus to engagement and action.¹⁵⁷ Thelwall cites contemporary debates on vitality, but declares himself dissatisfied:

Treatise after treatise has been written on the Vital Principle; theory has pulled down theory without end; and the gross contradictions which have marked the opinions of the greatest characters upon the subject, might

induce one to think that, even with respect to the *general idea*, we are still entirely at a loss; and that we are seeking for an *imaginary something* – a phantom of the brain, which, perhaps, has no real existence.¹⁵⁸

The vital spirit is considered ‘something’, yet it is undetectable, and perhaps even imaginary. Thelwall concludes that researchers will be ‘at a loss’ if they consider it ‘a *distinct, or independent essence*, separable from the effects and actions by which the *state of vitality* is to be ascertained’.¹⁵⁹ He denies that the vital principle is ‘a distinct something, in itself alive’, which is ‘superadded to organized matter’. He asserts that vitality is ‘an effect of the co-operation of other principles, or *natural* and pre-existing causes’.¹⁶⁰ Thelwall considers the philosophical and theological implications of his claims, but sustains his materialist position, and argues against the immaterial implications of a ‘superadded’ vital spirit. He notes that immaterialist models are updates of ancient claims for ‘the *soul or vital principle*’, ‘with the slight alteration only of transposing the *soul* into the place of *mind or Spirit*, and substituting *Vital Principle* in the place of soul’.¹⁶¹ Thelwall presents his case, in contrast, as enlightened, secular and modern:

Regarding man as differing from other animals rather in the extent than the nature of his powers, [I] shall consider him...as consisting of a simple organized frame, from the susceptibility and presence, or the non-susceptibility, or absence, of stimuli in which arises the whole distinction between the *living* body and the *dead*.¹⁶²

Thelwall is doubly provocative, aligning human life with that of animals, and making the vital principle a material ‘stimulus’ not an immaterial ‘spirit’. Though he does not mention electricity, his arguments echo debates over the material or immaterial qualities of the electric fluid that we saw in [Chapter 2](#).

Thelwall’s ‘materialist’ account of vitality consists of two conditions, first the ‘*perfect harmony of organized parts, by which the animal frame is rendered...susceptible of the proper stimuli*’, and second, the stimulus itself.¹⁶³ Thelwall emphasises that this position is controversial, noting the reaction it provoked at a debating society:

all of a sudden, a sneer went round the Theatre, and a hundred mouths were filled with fury against me, as though I had stood up, in the presence of the Pope and the Cardinals, to deny the doctrine of the Trinity. I shall venture,

however, once more to assert, that the spiritual allusions of this sentence are to fine for the gross conceptions of my material organs.¹⁶⁴

Thelwall notes the iconoclastic implications of his theory, but pushes no further. The obscurity of the question is useful for his argument as all investigators are equally restricted by the lack of empirical supporting evidence. But Thelwall's insistence on the obscurity of the debate perhaps acknowledges that his account of vitality aligns closely with the super-addition model that he ridicules.

Thelwall's 'stimulus' is added to organised matter, and his materialist argument thus rests on the identity of this 'stimulus'. He suggests throughout that it is material not spiritual, but only at the close of the *Essay* does he offer a detailed account of it, shifting between suggestions that the stimulus is material, and hints that it is immaterial. First he entertains Hunter's suggestion that vitality is 'something' superadded to matter, but dismisses it, asking: 'But what is this *something that is not matter?* – Is it *Spirit?*' Thelwall denies that vitality could be a spiritual property, suggesting, like Priestley, that matter and spirit cannot interact. 'Such *Spirit*, however subtle, however refined, must still be material'.¹⁶⁵ In support of this claim for a superfine yet material 'spirit' Thelwall cites 'evidence in the action of air, and of the electric fluid'.¹⁶⁶ Electricity is the answer to the problem of vitality for Thelwall because it is a material phenomenon that acts like a spiritual one. In his closing remarks, he asks:

What can we discover so competent to the task – so subtle, so powerful, so nearly approaching to that idea of an ethereal medium, which some philosophers have supposed necessary to complete the chain of connection between the divine immortal essence and the dull inaction of created matter, as the electrical fluid? – that principle, whose presence, under such a variety of forms, is constantly presenting itself to the researches of the philosopher! – whose agency, in so many of the phenomena we are daily detecting! And which, perhaps, will one time be discovered to be the real principle by which all heat and action are originally generated and maintained!¹⁶⁷

Thelwall concludes with a confident claim for electricity as the stimulus of vitality, aligning his work with that of Darwin and Galvani.¹⁶⁸ And he repeats these claims for electricity in the 'Digression for Anatomists' in his *Peripatetic*, published in the same year as the *Essay*.¹⁶⁹ Though electricity is a material phenomenon, Thelwall notes its proximity to Newtonian

‘active powers’ with their divine origin. He stresses the scale of electricity’s influence; its ‘agency’ is seen in meteorological and planetary phenomena as well as in the human body. But he concludes by suggesting its essential obscurity. This obscurity is vital for Thelwall for political as well as philosophical reasons. Despite the repressive political atmosphere in which he is writing, Thelwall can, like Priestley, make claims for future progress; electricity’s power ‘will at one time be discovered’. Like Adam Walker, Thelwall suggests the immanence of human progress, and his emphasis on vitality strengthens his claims. The structural organisation of individuals and associations is already in place, and only awaits its electrical stimulus.

As Catherine Packham, Yasmin Solomonescu and others have noted, Thelwall’s model of electrical vitality informs his account of his own efforts to effect political reform.¹⁷⁰ His activity in the London Corresponding Society made him a target for government attention, and he was arrested and tried for treason in 1794. On his acquittal, he exploited the publicity raised by his trial to resume his political lecturing, and published his lectures in his journal *The Tribune*. Many of Thelwall’s *Tribune* lectures, and his later accounts of his lecturing, figure his oratory as electrical, thereby deploying the image of vitalising electrical communication for an explicitly radical cause.¹⁷¹ Thelwall is not the first to describe oratory in electrical terms; he seems to gesture to a tradition which describes the persuasive effects of an orator’s words as arising from the electrical energies of the body. Thomas Sheridan had declared in 1762 how in the finest oratory ‘the organs of the body, attuned to the exertions of the mind, through the kindred organs of the hearers, instantaneously, and, as it were with an electric spirit, vibrate those energies from soul to soul’.¹⁷² Thelwall echoes such claims in 1796:

the grand charm of oral eloquence consists . . . in that powerful harmony of feature and gesticulation – that electric animation of the eye, which . . . prepares the minds of the audience for the sentiments about to be delivered, and anticipates the impressions those sentiments are intended to inspire.¹⁷³

For Thelwall, like Sheridan, the orator’s ‘electric animation of the eye’ touches a correspondent chord in his audience. As in the *Essay*, electricity is a stimulus which awakens an organised mass. But informed by his work in the *Essay* and contemporary discussions of radical communication, Thelwall’s words take on new significance.

Thelwall emphasises the radical effects of his vitalising oratory in a letter to his wife of October 1795, declaring that his lectures

have shaken the pillars of corruption, till every stone of the rotten edifice trembled. Every sentence darted from breast to breast with electric contagion, and the very aristocrats... were frequently compelled by irresistible impulse to join in the acclamations.¹⁷⁴

This is an important example of Thelwall's claims for what Packham terms the 'animating force of his rhetoric'.¹⁷⁵ But the letter also gestures to other associations of electrical vitality, namely contagion and instinctive impulse, which come close to Burke's condemnations of electrical communication. Other contemporaries too read Thelwall's extraordinarily successful electric oratory as a threat. In George Walker's anti-Jacobin novel *The Vagabond* (1799), the naïve hero Frederick Fenton finds himself inspired by the example of Thelwall in a speech to a group of agricultural workers. Fenton urges them to resist the effects of enclosure and take back the common land, noting, 'I see the flame of liberty and truth flash in your countenances.' Fenton notes that the effect of his speech 'was like an electric shock, every man confessed its truth and the triumph of patriotism was complete'.¹⁷⁶ But when he is swiftly arrested, he realises that 'the disposition of a mob is always fickle', and 'those who a few minutes before hung with rapture on my words' abandon him once the electric effect of his rhetoric has faded.¹⁷⁷ This view of Thelwall's lecturing survived several decades, even among broadly sympathetic respondents. In an 1820 essay 'On the Difference between Writing and Speaking', William Hazlitt seems to echo Thelwall's own words, noting that in Thelwall's lectures 'the lightning of national indignation flashed from his eye, the workings of the labouring mind were seen labouring in his bosom'. But Hazlitt's description shifts as he declares that the electrical effects of Thelwall's oratory were also pernicious: his 'very popular and electrical effusions' were enabled by 'a certain exaggeration and extravagance of manner that covered the nakedness and swelled out the emptiness of the matter'.¹⁷⁸ However, in the letter to his wife as in the *Essay*, Thelwall is deliberately provocative, almost courting these critiques, and the mobile language of electricity is an important element of this provocation. Rather than seek to fix his electrical images, Thelwall himself points to the difficulty of controlling the effects of his electrical oratory, and seems to enjoy the stimulating, if discomfiting, effect of their mobility.

Though Thelwall's use of electrical language is often playful, and flirts with terms used to criticise him, the discourse of electrical vitality enables him to make sincere claims for the possibilities of reform. He represents his instruction as a form of vital principle, which will enliven his audience and his readers, stimulating them to activity but not anarchy.¹⁷⁹ In a 1795 *Tribune* lecture, he declares:

Now is the time to cherish a glowing energy that may rouse into action every nerve and faculty of the mind, and fly from breast to breast like that electric principle which is perhaps the true soul of the physical universe, till the whole mass is quickened, illuminated and informed.¹⁸⁰

The 'glowing energy' that Thelwall evokes is physiological, rousing 'every nerve and faculty of the mind', but it is not contained within the body; rather it flies 'from breast to breast'. In contrast to Burke's electrical contagion, this is a vitalising principle, that will 'quicken' the 'mass' of auditors and readers at large.¹⁸¹ But Thelwall's electrical image is complex and even threatens to escape his rhetorical control. His description of electricity as 'the true soul of the physical universe' is in tension with his 'simple principles of materialism'. But like Adam Walker, Thelwall makes electricity not the *anima mundi* but the 'soul of the physical universe'. He does not expand on this remark, but suggests, like Walker, that this vitalising spirit has a material basis in the bodies and minds of the populace. The lecture also echoes the *Essay* when he makes his words a stimulus to 'rouse' an immanent vitality in his audience. As Packham notes, Thelwall suggests that 'the desire for liberty . . . is already located within our "animal frames"'.¹⁸² He aligns himself with reformist writers including Helen Maria Williams for whom an electric fire of liberty 'finds a conductor in the human heart, escaping beyond its prescribed limits, and feel its strong concussion in every agitated nerve'.¹⁸³ But Thelwall emphasises that this enlivening communication occurs in a future state; as Packham notes, his words are 'prospective rather than retrospective, engendering rather than confining'.¹⁸⁴ Like his claims for future electrical discoveries, this future political vitalisation is a certainty, which only awaits its moment. Such claims work to undo hostile suggestions that his oratory is effective only in the moment.

Using a vitalising language of electricity Thelwall claims the salutary effects of political communication, placing him in a radical tradition from Priestley and Walker through Merry, Robinson and Darwin. But Thelwall also uses electrical language in a different way, and despite his pleasure in

the figurative play of electrical imagery, there are moments at which such language signals more pernicious forms of communication. When Thelwall departs from electricity's vital function, and focuses on its experimental manifestations, his language comes close to conservative condemnations of electrical communication. In a *Tribune* lecture of 1795, Thelwall condemns the conspiracies spread by the government, and notes:

Has not the present immaculate minister disseminated his alarms, like electric shocks, from one end of the country to the other . . . Has not the present minister, by those excellent conductors, warrants for high treason, proclamations, and reports of secret committees, conveyed his electric shocks of alarm through the country, till the whole deluded mass of the people shook with convulsions before him? Much to the amusement, no doubt, of the manager of the machine, though little to the health and benefit of those upon whom he operated.¹⁸⁵

This is a variation on Thelwall's images of the radical body politic, but the electricity operating here is not a vitalising force, but rather the shocks of a governmental electrical 'machine', the conductors of which are 'warrants', 'proclamations' and 'reports of secret committees'. This machine does not produce 'health and benefit'; it sends the 'mass of the people' into 'convulsions', but the 'manager of the machine' has no worries about the failure of his treatment; instead, it amuses him.

This account of the governmental electrical 'machine' helps elucidate another of Thelwall's engagements with electricity, which has attracted recent critical discussion. Jackson and Solomonescu have discussed Thelwall's fragmentary epic poem *The Hope of Albion* (1801) which adopts an electrical image to describe the transmission of feeling through a crowd:

All join the peal,
And swift, from man to man, contagious wrath
Spreads, direful: as, from group to group, expands
The electric fire, when to the crystal jar,
Or sphere excited, the hermetic hand
Applies the tried conductor, and relieves
The imprisoned element, whose subtle flames
Dart thro' the languid nerves, the fibres brace,
And with increas'd pulsation urge the heart.¹⁸⁶

The poem is set in Saxon Britain, but like Southey in *Wat Tyler* Thelwall employs an anachronistic image to connect his account with contemporary

politics. As in Thelwall's lectures, this 'electric fire' stimulates a crowd, a 'fierce throng' who 'kindle with martial rage'. But this electric fire does not issue from the crowd. It is applied from without, like the spark from the 'crystal' Leyden jar in electrical experiments. Jackson suggests that though the disembodied authority of the 'hermetic hand' is disturbing, this electric communication can stand for the positive effects of 'public opinion' and 'social energy'.¹⁸⁷ For Solomonescu in contrast, such 'electric fire' is an image of the coercive effects of Burkean counter-revolutionary rhetoric, suggesting 'that the popular imagination can be kindled both for and against the cause of reform'.¹⁸⁸ Thelwall's use of experimental rather than 'animal' electricity supports Solomonescu's reading of this passage. Paired with Thelwall's statement in the *Tribune*, these lines suggest that the 'hermetic hand' of the experimenter belongs to William Pitt or his representatives. Thus even Thelwall, the most adept appropriator of electrical imagery for reformist ends, indicates that electrical language can stand for the communication of coercive propaganda and violence when divorced from its vitalising effects.

We should avoid the tendency to align all images of electric communication with radical politics in the 1790s. Many counter-revolutionary writers make skilful use of such language to decry revolutionary activity, and to make a case for 'things as they are'.¹⁸⁹ Though reformist writers in Britain appropriate the image of rapid electrical communication, they struggle with the ways in which electricity resists any alignment with accounts of reason and progress. One reason for such resistance arises from electricity's association with obscure physiological processes of communication and vitality, and its indeterminate figurative status. But though this obscurity is disturbing to some reformers, the association between electricity and vitality, asserted by Darwin and Galvani, and adapted in myriad ways in the political writings of the 1790s, enables writers like Thelwall, Williams and even Wollstonecraft, to make positive claims for the future inevitability of reform, and its salutary effects. And through their embrace of figurative play, these writers can exploit, rather than distrust, electricity's indeterminacy.

NOTES

1. Hampsher-Monk, 'On Not Inventing', 148; Fulford, 'Man Electrified Man', 179. The 'note on the text' of this co-authored book states that this chapter 'originated in research by Tim Fulford' so in subsequent references to this chapter I cite Fulford as the author.

2. See also Morus, *Frankenstein's Children*, 134–135.
3. Darwin to Albert Reimarius, May 1756, *Collected Letters*, 25.
4. Focaccia and Simili, 'Luigi Galvani', 147–148.
5. *Ibid.*, 152.
6. *Ibid.*, 150; Galvani, *Commentary*, 70–71.
7. *Ibid.* See also Simili, 'Erasmus Darwin, Galvanism', 14.
8. Galvani, *Commentary*, 60.
9. *Ibid.*, 62; Spillane, *Doctrine of the Nerves*, 153.
10. Focaccia and Simili, 'Luigi Galvani', 154.
11. Jacyna, 'Galvanic Influences'; Fowler, *Experiments and Researches*.
12. Wilkinson, *Elements of Galvanism*, vol. I, 134–135, quoted in Jacyna, 'Galvanic Influences', 184.
13. Elliott, 'More Subtle than the Electric Aura', 209.
14. Simili, 'Two Special Doctors', 154; Simili, 'Erasmus Darwin, Galvanism', 25.
15. Priestman, *Poetry of Erasmus Darwin*, 133, 135. See also Simili, 'Erasmus Darwin, Galvanism', 18–19; Ruston, *Shelley and Vitality*, 31.
16. Darwin, *Poetical Works*, vol. I, xvii.
17. *Ibid.*, vii.
18. *Ibid.*, 13–14, 22–23, 27, 53, 62.
19. *Ibid.*, 38–40.
20. *Ibid.*, 38.
21. *Ibid.*, 41.
22. *Ibid.*, 42.
23. *Ibid.*
24. Fulford, 'Man Electrified Man', 183; Crosland, 'The Image of Science', 289; Clark, *Benjamin Franklin*, 84; Jackson, *Science and Sensation*, 46; Delbourgo, *A Most Amazing Scene*, 44, 52.
25. Darwin, *Poetical Works*, vol. I, 43–44.
26. Delbourgo, *A Most Amazing Scene*, 3.
27. List, 'Erasmus Darwin's Beautification', 402–403; Wylie, *Young Coleridge*, 52–53.
28. Hesiod, *Theogony*, 18–21.
29. Darwin, *Poetical Works*, vol. I, 45–46.
30. Priestman, *Poetry of Erasmus Darwin*, 195–196.
31. Darwin, *Poetical Works*, vol. I, 104–105.
32. *Ibid.*, 105.
33. Fulford, 'Man Electrified Man', 183.
34. Darwin, *Poetical Works*, vol. I, 106.
35. Eaton, *Politics for the People*; Priestman, *Poetry of Erasmus Darwin*, 198; Uglow, *Lunar Men*, 458.
36. Carroll and Prickett (eds.), *The Bible*, Isaiah 2:4, 766.

37. Darwin, *Zoonomia*, vol. I, 1.
38. *Ibid.*, 64.
39. *Ibid.*, 65.
40. *Ibid.*, 66; Simili, 'Two Special Doctors', 153.
41. Elliott, 'More Subtle than the Electric Aura', 210.
42. Darwin, *Zoonomia*, vol. I, 109.
43. Elliott, 'More Subtle than the Electric Aura', 216. See also Faubert, 'Erasmus Darwin'; Priestman, *Poetry of Erasmus Darwin*, 196–197.
44. *Poetry of the Anti-Jacobin*, 135.
45. *Ibid.*
46. Crosland, 'The Image of Science'. Priestley is depicted with a blunderbuss inscribed 'Royal Electric Fluid' in Isaac Cruikshank's caricature, 'The Friends of the People' (London, 1792).
47. Walker, *System of Familiar Philosophy*, vi.
48. Frances Burney to Mrs ****, 11 June 1790, *Diary and Letters*, vol. V, 139.
49. *Ibid.*, 140.
50. *Ibid.*
51. *Ibid.*, 140–141.
52. *Ibid.*, 141. Joseph Priestley and Anna Seward react more positively to Courtney's work. Joseph Priestley to Theophilus Lindsay, 13 May 1790, *Letters of Joseph Priestley*; Seward, *Letters of Anna Seward*, 20.
53. Courtenay, *Philosophical Reflections*, 1–3.
54. For the influential use of 'debate' to describe these events, see Cobban, *Debate on the French Revolution*.
55. Courtenay, *Philosophical Reflections*, 16.
56. *Ibid.*, 16–17.
57. Courtney's pamphlet is dated 26 April 1790. It anticipates both radical and conservative associations between the *ancien régime* and gothic structures. See Williams, *Letters from France*, 91; Burke, *Letter to a Noble Lord*, 65–66.
58. Courtenay, *Philosophical Reflections*, 46; Burke, *Select Works*, vol. II, 170–171.
59. Courtenay, *Philosophical Reflections*, 46.
60. Mahon, *Principles of Electricity*, 119.
61. *Ibid.*, 123, 245; Heilbron, *Electricity*, 462.
62. Burke, *Select Works*, vol. II, 257.
63. Gilmartin, 'Burke, Popular Opinion', 108–109.
64. Burke, *Select Works*, vol. II, 263.
65. Crosland, 'The Image of Science', 304. See also Stewart, *Second Peal of the Tocsin*, 2.
66. Crosland, 'The Image of Science'.
67. Burke, *An Appeal from the New*, 106.
68. Keen, *Literature, Commerce*, 187–188; *For the benefit of Mr Katterfelto's Black Cat*.

69. *The World*, 6 August 1791.
70. Playfair later returned to England and aligned himself with the reactionary Crown and Anchor Association, offering his pamphlets to the Association for circulation to its members. Graham, *The Nation*, vol. I, 307, 413.
71. Playfair, *Letter to the People of England*, 1.
72. *Ibid.*, 21.
73. *Ibid.*, 22.
74. Playfair, *The History of Jacobinism*, 144. Playfair's statement is quoted (unattributed) in the *Prospectus of the Revolutionary Magazine*, 55–56.
75. Paine was occasionally associated with electrical science, especially Franklin. *Whitehall Evening Post*, 4 May 1791.
76. Adams, *Observations on Paine's Rights of Man*, 6.
77. *Ibid.*, 26. For Adams's distancing of America from Europe's problems see also *ibid.*, 39, 48.
78. *Ibid.*, 27.
79. *Ibid.*, 28.
80. Long, *The Antigallican*, 18–19.
81. Gilmartin, *Writing against Revolution*, 23.
82. Long, *The Antigallican*, 23. Compare Burke, *Select Works*, vol. II, 173.
83. Long, *The Antigallican*, 53.
84. *The Times*, 19 July 1791.
85. Priestley, *Experiments and Observations* (1774), xiv.
86. Priestley, *An appeal to the public*, 30. See Guest, *Unbounded Attachment*, 48–49.
87. *The Times*, 19 July 1791; Priestley, *An appeal to the public*, 26. Priestley even reproduces the bill itself, *ibid.*, 129.
88. See Graham, *The Nation*, vol. I, 483–484.
89. Young, *The Example of France*, 101. Compare *The Times*, 22 January 1798. We see a similar use of this image in the anonymous *Funeral oration for Louis XVI*, 5–6.
90. Morgann, *Considerations*, 2.
91. *Ibid.*, 20.
92. *Ibid.*, 21.
93. *Ibid.*, 21–22. Compare Playfair, *The History of Jacobinism*, 170–171, 175–176.
94. Morgann, *Considerations*, 22–23.
95. Bowles, 'Farther Reflections', 203–204.
96. *Ibid.*, 204–205.
97. *Ibid.*, 205–206.
98. Burke, *Select Works*, vol. II, 145.
99. Vincent, 'Real Grounds of the Present War', 396; Lock, *Edmund Burke*, vol. II, 534–555; Burke, *Correspondence*, vol. VIII, 415.

100. Lock, *Edmund Burke*, vol. II, 534–555.
101. ‘*A Letter from the Right Hon. Edmund Burke*’, 337, 340. See Crosland, ‘The Image of Science’, 300.
102. Burke, *Select Works*, vol. III, 41.
103. ‘*A Letter from the Right Hon. Edmund Burke*’, 342.
104. Burke, *Select Works*, vol. III, 81. See also *ibid.*, 52–53, 79, 172.
105. *Ibid.*, 48. See also *ibid.*, 175.
106. *Ibid.*, 90–91.
107. *Ibid.*, 91.
108. *Ibid.* See Fairclough, *Romantic Crowd*, 74.
109. Burke, *Select Works*, vol. III, 73.
110. *Ibid.*, 65.
111. *Ibid.*, 63–64.
112. *Ibid.*, 47; see also *ibid.*, 40.
113. *Ibid.*, 62. See Fairclough, *Romantic Crowd*, 69–70.
114. Burke, *Select Works*, vol. III, 181–182.
115. *Ibid.*, 42.
116. *Ibid.*
117. See also Stafford, *Body Criticism*, 8.
118. Burke, *Select Works*, vol. III, 206.
119. *Ibid.*, 217; see also *ibid.*, 213.
120. *Ibid.*, 52.
121. ‘Troponian, adj.’, *OED Online*, May 2016, Oxford University Press, <http://www.oed.com/view/Entry/206697>.
122. Burke, *Select Works*, vol. III, 108.
123. *Ibid.*
124. Pocock, ‘Edmund Burke’, 34.
125. For a discussion of the telegraph as a communicative medium see Fairclough, ‘*The Telegraph*’, 34–38.
126. Mee, *Print, Publicity*, 8–9, 34–42. My thanks to Jon for allowing me to see the book at proof stage.
127. *Ibid.*, 37. See also Warner, *Letters of the Republic*, 3.
128. Barbauld, *An address to the opposers*, 7–8.
129. ‘Their signatures ought, in my opinion, to have been annexed to their instrument’. Burke, *Select Works*, vol. II, 92.
130. *The correspondence of the Revolution Society*, 50.
131. *Ibid.*, 196.
132. Noel Jackson and Nicholas Roe have described reformers’ use of vitalist language to account for the enlightening effects of reformist ideas. Here I examine the effects of connecting such language with metaphors of electricity. Jackson, *Science and Sensation*, 47–48; Roe, *The Politics of Nature*, 92–93.

133. Thermistocles, Address to Mr Pitt, *Public Advertiser*, 8 June 1790.
134. Coleridge, *The plot discovered*, 45.
135. Southey, *Wat Tyler*, 66.
136. Fulford, ‘Man Electrified Man’, 181.
137. Southey to Davy, 26 July 1800, https://www.rc.umd.edu/editions/southey_letters/Part_Two/HTML/letterEEed.26.540.html. See also Fulford, ‘Man Electrified Man’, 186; Golinski, *Science as Public Culture*, 205.
138. Godwin, *Enquiry concerning Political Justice*, vol. I, 21.
139. *Ibid.*, 207. See Fairclough, *Romantic Crowd*, 94; Weston, ‘Politics, Passion’, 447–448; Philp, *Godwin’s Political Justice*, 93.
140. Godwin, *Enquiry concerning Political Justice*, 208.
141. Wollstonecraft, *Vindication of the Rights of Woman*, 259. But reason and passion in Wollstonecraft’s *Vindication* ‘are always allied’. Taylor, *Mary Wollstonecraft*, 52.
142. Wollstonecraft, *Vindication of the Rights of Woman*, 260.
143. *Ibid.*, 260–261.
144. Wollstonecraft, *The Wrongs of Woman*, 73.
145. Wollstonecraft, *Vindication of the Rights of Woman*, 260–61.
146. Hays, *Letters and Essays*, 55–56.
147. *Ibid.*, 160.
148. Hays, *Emma Courtney*, vol. II, 14.
149. Godwin, *Political and Philosophical Writings*, vol. IV, 159, 211. See Fairclough, *Romantic Crowd*, 96.
150. See Fairclough, *Romantic Crowd*, 82–107.
151. Thelwall, *Letter to Henry Cline*, 1–3.
152. Hunter, *Works of John Hunter*, vol. I, 221, 223.
153. Thelwall, *Essay Towards a Definition*, 13.
154. *Ibid.*, iii, iv.
155. *Ibid.*, 3–4.
156. *Ibid.*, 2–3.
157. Catherine Packham notes the importance of ‘conjecture’ in Thelwall’s work more broadly in Packham, *Eighteenth-Century Vitalism*, 128.
158. Thelwall, *Essay Towards a Definition*, 7.
159. *Ibid.*
160. *Ibid.*, 8–9.
161. *Ibid.*, 10–11.
162. *Ibid.*, 12.
163. *Ibid.*, 33.
164. *Ibid.*, 34–35. See Packham, *Eighteenth-Century Vitalism*, 127 for more on the political implications of Thelwall’s physiological papers.
165. Thelwall, *Essay Towards a Definition*, 35–36.
166. *Ibid.*, 36.

167. *Ibid.*, 39–40.
168. Solomonescu, *John Thelwall*, 19.
169. Thelwall, *Peripatetic*, 146. See Fairclough, *Romantic Crowd*, 110–112.
170. Packham, *Eighteenth-Century Vitalism*, 126–127; Solomonescu, *John Thelwall*, 23–26; Mee, *Romanticism, Enthusiasm*, 116–117, 119; Fairclough, *Romantic Crowd*, 116.
171. Fairclough, *Romantic Crowd*, 130–131.
172. Sheridan, *A Course of Lectures*, 187–188. See also Polwhele, *The English Orator*; Goring, *Rhetoric of Sensibility*, 41–42.
173. Thelwall, *Prospectus of a Course of Lectures*, 3.
174. Thelwall, *Life of John Thelwall*, 367; and Thompson, ‘Disenchantment or Default?’, 157.
175. Packham, *Eighteenth-Century Vitalism*, 132.
176. Walker, *Vagabond*, 134.
177. *Ibid.*, 135.
178. Hazlitt, *Complete Works*, vol. XII, 264–265. See Fairclough, *Romantic Crowd*, 130–131.
179. As Jon Mee notes, this is a difficult task for Thelwall; Mee, *Romanticism, Enthusiasm*, 119, 116–117.
180. Thelwall, *The Tribune*, vol. III, 265.
181. Packham, *Eighteenth-Century Vitalism*, 143.
182. *Ibid.*, 128–129; see also 126, 132.
183. Williams, *Tour in Switzerland*, 6–7. See Fairclough, *Romantic Crowd*, 79–80.
184. Packham, *Eighteenth-Century Vitalism*, 143.
185. Thelwall, *The Tribune*, vol. I, 295.
186. Thelwall, *Poems Written in Retirement*, 197.
187. Jackson, *Science and Sensation*, 53–58.
188. Solomonescu, *John Thelwall*, 83–84.
189. Godwin, *Caleb Williams*.

Electrochemistry, Matter and Life

In 1800 the debates over the nature of animal electricity sparked by Luigi Galvani's work brought unexpected insights into the use of electricity in chemistry. Alessandro Volta took issue with Galvani's claim that animal electricity was distinct from 'common electricity', asserting that the twitching of Galvani's frogs was produced by the contact of metals in the electrical circuit. To prove this, Volta developed the 'galvanic pile', a series of discs of different metals suspended in liquid, which was capable of producing a sustained electric current.¹ Volta announced his creation of the pile in a letter to Joseph Banks, President of the Royal Society in the spring of 1800, and emphasised that for the first time experimenters could produce a constant supply of the 'electrical fluid'. In his letter Volta notes the 'inexhaustible charge' of his pile, comparing it 'to the Leyden flask, or, rather, to an electric battery weakly charged acting incessantly'.² But Volta also stresses the differences between the new apparatus and those older electrical technologies. He had achieved his extraordinary breakthrough by studying the production of electricity in organic rather than mechanical structures, and notes in his letter that because his pile is 'much more similar . . . in its form to the *natural electric organ* of the torpedo or electric eel, &c. than to the Leyden flask and electric batteries, I would wish to give [it] the name of the *artificial electric organ*'.³ Though Volta developed his pile in order to rebut Galvani's claims for the production of a distinct 'animal electricity', he too drew inspiration from organic

structures. And like his predecessors, he appealed to the evidence of the body to endorse the power of the pile, noting that the ‘endless circulation of the electric fluid . . . may appear paradoxical and even inexplicable, but it is no else true and real; and you may feel it . . . with your hands’.⁴ In his letter, Volta gestures to the possible applications of his pile: it ‘will open a very wide field for reflection, and of views, not only curious, but particularly interesting, to medicine. There will be a great deal to offer the anatomist, the physiologist, and the practitioner’.⁵ Volta anticipates that the primary uses of the pile will be in the analysis of organic structures and in medicine. But electricians in Britain soon observed a distinct use for the pile, in chemistry.

Though Volta’s letter did not appear in print until the summer of 1800, Banks had received the manuscript in April of that year, and soon shared it with colleagues at the Royal Society.⁶ Anthony Carlisle and William Nicholson built a pile according to Volta’s design but put it to a new use, employing ‘the agency of electricity in chemical operations’ by decomposing water into its constituent elements hydrogen and oxygen.⁷ In doing so, they demonstrated for the first time the application of Volta’s pile in chemistry, reducing compound substances to their constituent elements. They even hinted at their dissent from Volta’s view that the continual electric current was produced by the contact of the metals in the pile. Carlisle and Nicholson’s experiment opened up the possibility that not only was the chemical reaction in the pile produced by electricity, but also that its electric force might be produced by the chemical reaction.

Volta’s pile thus appeared to his contemporaries both a culmination of earlier work in electricity, and a distinct departure from it. Priestley had noted in 1767 that the connections between electricity and chemical structures were under-explored, noting of chemistry:

Here seems to be the greatest field for the extension of electrical knowledge: for chymistry and electricity are both conversant about the latent and less obvious properties of bodies; and yet the relation to each other has been but little considered; few of our modern electricians having been either speculative or practical chemists.⁸

Volta’s battery enabled experimenters to bridge this gap. Chemists could now use electricity as an experimental tool, and explore the nature of electrical forces themselves. And yet electrochemical work was still influenced and troubled by the ‘latent and less obvious’ qualities of both

electricity and chemistry. This chapter will address some of the ‘latent’ qualities of electrochemical work in the first decades of the nineteenth century. Despite the efforts of some electrochemists to limit the scope of their field to the combination of elements in inorganic compounds, Volta and Galvani’s physiological work continued to have important influence, and it proved extremely difficult to separate chemistry from physiology, and electricity from obscure questions of vitality.⁹

The new era ushered in by Volta’s pile also stimulated a new kind of scientific publication. Though Volta’s announcement of the development of his pile was delayed by many months before its appearance in *Philosophical Transactions*, notice of Nicholson and Carlisle’s work was published immediately after the reading of Volta’s paper at the Royal Society. The report of their experiment appeared in Nicholson’s own *Journal of Natural Philosophy, Chemistry and the Arts*, known as *Nicholson’s Journal*, a popular monthly publication which could publish the latest experimental research speedily. As Samuel Lilley and Jan Golinski have discussed, Nicholson and Carlisle’s account of the chemical operation of Volta’s pile rapidly stimulated a flurry of articles on electrochemistry, published in *Nicholson’s Journal* and its rival, Alexander Tilloch’s *Philosophical Magazine*.¹⁰ The significance of Nicholson’s breakthrough gave important kudos to his magazine, but just as significantly, his magazine enabled a wide range of practitioners to test ‘the chemical powers of this new tool’ in just a few months.¹¹ *Nicholson’s Journal* was a commercial publication independent of any scientific society, and was not constrained by the slower publication procedures of the Royal Society’s *Philosophical Transactions*. As Lilley notes, only a publication of this kind, ‘where papers often appeared within a fortnight of writing, could provide for such rapid developments as occurred in electro-chemistry in 1800’.¹² The sheer number of experimenters working with the pile meant that there was little consensus as to whether Nicholson and Carlisle had indeed managed to separate water into hydrogen and oxygen, or whether there was an alternative explanation for the effects they witnessed.¹³ But Nicholson and Carlisle’s electrochemical work achieved such a high profile that it effected a shift in the public’s understanding of electrochemistry. The decomposition of water was not just chemical news, but news. The *Morning Chronicle* reported on 30 May 1800 of Thomas Garnett’s repetition of the decomposition of water at London’s fashionable scientific establishment the Royal Institution. The paper called it ‘a curious experiment, on which we cannot reflect without thinking that it may lead to some important

enquiries, and may throw light on several phenomena of the Animal Economy, as well as Chemistry and Electricity'.¹⁴ Like Volta, the *Morning Chronicle* emphasises the open-endedness of the pile's potential applications. Though it has produced wonderful results in chemistry, these results, the paper implies, are connected with its operation in the 'animal economy'. Such connections between electrochemistry and physiology are sustained in the aftermath of Nicholson and Carlisle's work.

One of those who joined the rapid expansion in electrochemical research in 1800 was Humphry Davy. Davy was soon to move to London to take up a position at the Royal Institution but in 1800 worked in Bristol as assistant to Thomas Beddoes at his Pneumatic Institute. Davy read about and contributed to the development of electrochemistry in the pages of *Nicholson's Journal*, publishing five papers on galvanic phenomena between September 1800 and January 1801. Despite the controversy over the findings of Nicholson and Carlisle's experiment, Davy quickly accepted that Volta's instrument enabled the decomposition of compounds, and proceeded to use it as a tool for further electrochemical work.¹⁵ But Davy was circumspect about the precise function of the pile. He declined to speculate on the causes of its operation, focusing instead on its effects, though he suggested like Nicholson and Carlisle that the electric current itself might be a chemical phenomenon.¹⁶ Looking back in 1812, he declared: 'it was not till the era of the wonderful discovery of Volta... that any great progress was made in chemical investigation by means of electrical combinations'.¹⁷ Davy made Volta's pile the symbol of his self-appointed task to modernise and standardise chemical methods in the first fifteen years of the new century. He used the pile to divide chemical compounds into their constituent elements, overcoming scepticism and competition from French chemists like Joseph Louis Gay-Lussac, and isolating elements like potassium and sodium. He even claimed that chemical affinity is itself electrical, joining philosophers like André-Marie Ampère in showing 'the dependence of the chemical arrangements of matter upon electrical functions'.¹⁸

However, Davy's early work on galvanism also demonstrates his interest in the physiological structure and function of Volta's pile.¹⁹ This interest is sustained in some form throughout Davy's writings, and is taken up by other researchers in the 1810s. While Golinski, Knight and others have offered important studies of the crucial and contested breakthroughs in Davy's electrochemical work, I aim to show how the focus of historians of chemistry has tended to obscure the degree to which his galvanic work

continues to engage with physiological concerns. As Pancaldi suggests, at the time of Davy's greatest achievements Volta's pile was interpreted as being 'between animal and non-animal things'.²⁰ Electricity in electrochemistry retained its status as a 'latent', obscure principle whose vital properties affected both organic and inorganic structures.

Like Davy, I read Volta's pile as forming a new era in electrical research, but this is not necessarily a new era of clarity and specialisation; an obscurity about the operation of electricity remains even in Davy's electrochemical work. To an increasing degree Davy became identified with Volta's pile over the course of his early career.²¹ He was among the first to recognise its power as an analytical instrument and as Golinski notes, he 'black-boxed' it, transforming its function 'from an experiment into an instrument, with which new discoveries could be made'.²² Davy's financial support at the Royal Institution enabled him, with colleagues like J. G. Children, to develop ever-larger and more sophisticated versions of the pile.²³ As Golinski and Klancher have noted, Davy's development of the pile increased the specialisation of chemical research because in contrast to the early days of Volta's instrument electrochemical work was now the province of a specialist experimenter working with expensive equipment.²⁴ Such specialisation seems anathema to Priestley's vision for collaboration in natural philosophy, but again, electricity connects the work of Priestley and Davy in unexpected fashion. Even in Davy's work, both chemistry and electricity retain the obscurity Priestley identifies. The unexpected connections between Davy and Priestley extend to the political implications of their work. While Davy is often claimed, in contrast to Priestley, as an increasingly conservative figure, his account of electricity complicates any straightforward account of the conservative character of his work.²⁵

Despite his explicit focus on inorganic chemical compounds, the electrochemical research of Davy and his peers is connected to contemporary investigations of vitality suggested by Volta and Galvani's work. Jacyna and Sharon Ruston have investigated contemporary debates about electricity and its connections with living matter, and note that they were never a purely 'scientific matter' but passed over into other forms of social and cultural expression.²⁶ The ferocity of discussions of vitality in these decades was intense, as commentators emphasised their ethical and religious implications. I follow Ruston's investigation of John Abernethy and William Lawrence's debates over the electrical nature of vitality, in which she stresses their partisan and political nature, declaring that 'Science was used by vitalists to sustain a particular model of power and by materialists to question and disrupt that model.'²⁷ I argue for the

polemical nature of Abernethy and Lawrence's accounts of vitality, but suggest that the operation of electricity in general, and Davy's electrochemistry in particular, in their texts upsets any clear divide between the conservative Abernethy and radical Lawrence. Mary Shelley's novel *Frankenstein* also demonstrates how electricity's vital properties resist any clear ideological or ethical label. The science of chemistry is key to understanding the operation of electricity in these discussions of vitality. Victor Frankenstein notes that when investigating life and death 'chemistry, in the most comprehensive sense of the term, became nearly my sole occupation'.²⁸ Shelley's account of chemistry in the novel is deeply indebted to Davy's work, not only in the bombastic expressions of Victor's tutor Professor Waldman, but also in the radically obscure operation of electricity in Victor's chemical research.

I begin with an account of Davy's electrochemical experimentation, before considering its significance for contemporary discussions of vitality, and suggest how his account of electricity sustains the productive obscurities which are so vital to Shelley in particular. I end the chapter with another appropriation of Davy's electrochemical work in a very different context. In his journal *The Republican* and his *Address to the Men of Science* the radical journalist and publisher Richard Carlile attempts to pin down the ideological qualities of electrical vitality and to put them to work for a radical cause. Even in Carlile's writings, electricity seems to resist such control. As in the work of reformers in the 1790s discussed in [Chapter 4](#), electricity is linked with radicalism in Carlile's work, but his writings reflect the altered understandings of the scope of electricity in the wake of Davy's electrochemical research. But Carlile's writings also suggest that a rereading of the politics of Davy's electrochemistry is necessary. Golinski has noted how Davy was a target for the criticism of reformist artisan chemists in the mid-1820s, but Carlile's publications provide an important pre-history to those discussions.²⁹ Davy's electrochemistry enables Carlile to assert his republicanism and atheism, and to celebrate the communicative role of the periodical press, but electrical language proves a difficult tool for Carlile because, like Davy and the other writers under discussion in this chapter, he finds that it resists clear political meaning.

1 HUMPHRY DAVY

Davy's startlingly successful lecturing and research career at the Royal Institution has often been described in political terms. For Fulford, Davy's systematising ethos and his courting of the social elite make his

electrochemical work counter-revolutionary: ‘Davy turned electrical science away from the radical context that its association with American and French revolutionaries had given it. He caused a change in its symbolism in the process.’³⁰ But though such order and rank were the aims and achievements of Davy’s career, his use of electricity complicates this reading of his works. As we have seen in [Chapter 4](#) the political ‘symbolism’ of electrical language is radically unstable in the 1790s, and even in Davy’s systematising work electricity retains an obscurity which unsettles its political significance. John Davy’s 1841 biographical account of his brother acknowledges the connection between radical politics and speculative experimentation in Davy’s early career:

the period of his noviciate was peculiar, marked by excitement and innovation... the leaven of the French Revolution was still fermenting; – the mysterious phenomena of Galvanism had then recently been brought to light; the muscles of animals apparently dead had been made to contract by the new influence, as if re-animated... It is not remarkable then... that at the age of nineteen he thus indulged in speculation; but it is very remarkable, how soon he saw his error, and ever afterwards avoided it.³¹

John Davy makes the connection between revolution and galvanic experimentation explicit, and indeed as Golinski has discussed, Davy’s early notebooks demonstrate his captivation with the possibility that galvanic phenomena might ‘open a window into the realm of the subtle fluids that animated living matter and activated the nervous system’, speculation which connects Davy’s work with materialist and reformist thought.³² John Davy distinguishes the ‘error’ of Davy’s early speculations from the electrochemical achievements that followed. But this account of Davy’s turn away from the connection between galvanism and vitality is not supported by the work itself. He engages with galvanic phenomena in living bodies throughout his career, even declaring in his final published paper in 1829 that ‘it is surprising to me that the electricity of living animals has not been more an object of attention, both on account of its physiological importance, and its general relation to the science of electro-chemistry’.³³ Here and elsewhere Davy suggests that electrochemical techniques might be applied to organic matter; among his authoritative claims for electricity’s power to isolate chemical elements we thus find suggestive hints that it operates on living matter too.

The term galvanism itself signals a connection between Davy’s electrochemical experimentation and Galvani’s animal electricity. John Davy’s

reference to galvanism signifies the use of electricity in vitalist experimentation not electrochemistry, but in Davy's first uses of Volta's pile the distinction between the two practices is not always clear. 'Struck by the curious phenomena noted by Messrs. Nicholson and Carlisle', Davy began making electrochemical experiments in 1800, publishing his findings in *Nicholson's Journal*.³⁴ Like Nicholson and Carlisle, Davy took issue with Volta's claim that the contact of metals in the pile was the cause of the electric current, asserting instead that a chemical reaction produced the electric current.³⁵ Davy's tone in these early articles is often circumspect; he notes in October 1800: 'I shall, at present, offer no theoretical conjectures concerning these experiments', and as June Fullmer notes, like earlier electricians, he is hampered by 'the absence of suitable of language... to describe the device, its parts, its effects and its operation'.³⁶ Despite these obstacles, Davy makes his case for the chemical operations of Volta's pile in November 1800, noting of an experiment on the oxidation of zinc: 'It seems, therefore, reasonable to conclude, though with our present quantity of facts we are unable to explain the exact mode of operation, that the oxidation of the zinc in the pile, and the chemical changes connected with it, are *some how* the cause of the electrical effects it produces.'³⁷ Davy emphasises the obscurity of 'the exact mode of operation' of the pile, but does not dwell on this issue, moving instead to the important conclusion that the galvanic current is electrical in nature and that it results from a chemical reaction.

Davy's claims for the function of the Voltaic pile are enabled by a series of pragmatic decisions. He does not attempt to explain how electricity is produced, and he focuses on its operation on inorganic compounds rather than the greyer areas of animal matter.³⁸ The final paper in his series of letters to *Nicholson's Journal* dated 23 January 1801 demonstrates the strengths of that pragmatic approach, but also suggests the porous nature of the limits he has set. Davy begins by asserting that he will focus on 'the agency of galvanism upon inorganic bodies' not organic matter.³⁹ He sustains this focus on inorganic chemistry in most of his electrochemical work, including his major statement on the power of the Voltaic pile in the Royal Society's Bakerian Lecture of 1806. And yet the close of this letter suggests that he has not banished all thought of the physiological function of galvanic forces. He declares: 'there exists in living matter galvanic action independent of all influence generated by metallic oxidation. I have produced the phenomena of taste and muscular irritation by means of metals, in cases where they were apparently incapable of undergoing chemical

change.⁴⁰ In this his last word on galvanism in *Nicholson's Journal* Davy reintroduces the possibility that galvanic forces arise from and affect physiological structures in a way distinct from its chemical operation, but arising from the same causes.⁴¹ And he reiterates his interest in the physiological operation of galvanic forces even in his new environs at the Royal Institution in London. Davy began his lecturing career there in 1802, with a series on chemistry. I discuss his celebrated introductory 'Discourse' to that series below, but in the syllabus to the series, Davy signals his continued interest in the connection between galvanic chemistry and physiology:

The general connection of electricity with physiology and with chemistry, which is at present involved in obscurity, is probably capable of experimental elucidation; and the knowledge of it would evidently lead to novel views of the philosophy of the imponderable substances.⁴²

The obscure connection between galvanic forces in chemical compounds and in living matter is a useful problem for Davy, because it suggests the potential for future progress in electrical science. But it also demonstrates that the brilliant clarity of Davy's electrical decomposition of chemical compounds is never far removed from the more uncertain provenance and operation of galvanic forces in living bodies.

Davy criticised the way that the experimental possibilities opened up by Volta's pile continue to be known by the term galvanism. He declared in an 1810 lecture offering a 'Historical sketch of electrical discovery' that '[a]s it is to Volta that we owe the great progression in the science, it is wholly inconsistent with the feeling of justice that the name of Galvani should be associated with his discoveries. Galvanism and galvanic batteries will, I trust, soon become obsolete terms.'⁴³ But despite his concerns, Davy's electrochemical work continued to be labelled 'galvanic', and as John Davy's description of Davy's early work demonstrates, it thus retained a connection with at times disreputable physiological research. Galvani's nephew Giovanni Aldini conducted a series of spectacular public experiments in London in 1802 and 1803 in which he aimed to prove Galvani's suggestion that animal electricity constituted 'an electricity peculiar to animals' that might even be a vital spirit.⁴⁴ Aldini used Volta's pile to 'animate' animal and even human corpses. On 17 January 1803 he conducted galvanic experiments on the body of the executed murderer George Forster. The report of Aldini's experiment in *The Times* veered between a prurient attention to its gruesome elements, and loftier claims for its medical applications. But in

both modes, *The Times* claims a connection between galvanism and vitality. ‘On the first application of the process to the face, the jaw of the deceased criminal began to quiver, and the adjoining muscles were horribly contorted, and one eye was actually opened. . . It appeared to the uninformed part of the by-standers as if the wretched man was on the eve of being restored to life.’ The article distinguishes its readers from these ‘uninformed’ observers, noting that such a return to life ‘was impossible’. Yet in claiming the future utility of galvanism the article comes close to reiterating such ‘uninformed’ suggestions. ‘In cases of drowning or suffocation, it promises to be of the utmost use, by reviving the action of the lungs, and thereby rekindling the expiring spark of vitality.’⁴⁵ In Aldini’s work, Galvani’s claims for electrical vitality find renewed force. Though Aldini is criticised as a showman, he uses the same equipment as Davy, and adopts similar claims for the applications of his work. The obscurity of the galvanic force means that Aldini’s claims remain vague, but they gain a rhetorical potency from that obscurity, which is echoed in Davy’s electrochemistry.

Davy’s personal and professional ambitions for chemistry as a professionalised science seem to necessitate that he distance his work from less reputable forms of galvanism. Iwan Rhys Morus notes that he disavows Aldini’s work, a ‘disavowal’ that establishes ‘his own espousal of galvanism as disembodied, insulated from the culture of sensation and . . . re-embodied in the new and powerful instrumentation that he developed . . . at the Royal Institution’.⁴⁶ In the *Edinburgh Review* in 1803, Davy calls Aldini’s Forster experiment ‘rather disgusting than instructive’.⁴⁷ But in accounts of his own work, he does not emphasise the distinctions between his electrochemistry and other forms of galvanism, because the imperfectly defined limits of all galvanic science enables him to make the case for the future prospects of chemical research. Davy’s celebrated ‘Discourse Introductory to a Course of Lectures on Chemistry’ (1802) sets out his vision for the development of chemistry, and he refuses to limit its scope to ‘disembodied’ inorganic matter.

The phaenomena of combustion, of the solution of different substances in water, of the agencies of fire . . . and the conversion of dead matter into living matter by vegetable organs, all belong to chemistry; and, in their various and apparently capricious appearances, can be accurately explained only by an acquaintance with the fundamental and general chemical principles.⁴⁸

Davy returns to ‘dead’ and ‘living matter’ later in the ‘Discourse’, declaring ‘the nourishment and growth of organized beings’ is ‘dependent . . . upon

chemical processes'.⁴⁹ He even seems to address 'galvanic' experiments such as Aldini's, and though he distinguishes this galvanic science from his electrochemistry, acknowledges that they are both chemical practices. Davy does not condemn such experimentation, though he urges caution:

If the connection of chemistry with physiology has given rise to some visionary and seductive theories; yet even this circumstance has been useful to the public mind . . . in leading it to new investigations. A reproach . . . has been thrown upon those doctrines known by the name of chemical physiology; for in the applications of them, speculative philosophers have been guided rather by the analogies of words than of facts. Instead of slowly endeavouring to lift up the veil concealing the wonderful phaenomena of living nature, they have vainly and presumptuously attempted to tear it asunder.⁵⁰

Davy criticises the presumption of such physiological work and its reliance on 'analogies of words', but does not discredit it. In his 'Observations relating to the Progress of Galvanism' published in the *Journals of the Royal Institution* in 1802 he even suggests that 'the animal organs are capable . . . of exerting an action similar to the metals, in producing galvanic electricity'.⁵¹ Throughout his work for the Royal Institution Davy sustains the possibility of a connection between galvanic effects on chemical compounds and on organic bodies. His precise galvanic work is connected with the showmanship of Aldini by their shared exploitation of the mysterious operations of electricity. Like the electrical forces with which he works, Davy's electrochemistry has a physiological as well as a purely experimental function, which remains fundamentally obscure.

At times in the early part of his career Davy does attempt to shed further light on the provenance of electricity, and even seems to question claims that electricity is an 'imponderable fluid'. He declares in his first publication, the 1799 *Essay on Heat, Light and the Combinations of Light* that electricity is one of 'those ethereal fluids, which at present elude the perfection of our organs, and are only known by their effects'.⁵² He moves between scepticism and speculation about these imponderables in the *Essay*, declaring that caloric, or heat, is a purely 'imaginary fluid', but supporting those who claim 'the nervous fluid to be the electric aura'.⁵³ Here as in Davy's later work the immediate clarification of these uncertainties is less important than his claims that chemical science will achieve it in the future: 'Every change in our sensations must be accompanied with

some correspondent change in the organic matter of the body. These changes an extensive and philosophical chemistry may enable us to estimate.’⁵⁴ In the 1802 ‘Discourse’ too, rather than dwell on the question of which might be the most appropriate model for the operation of electricity, Davy offers grand claims for the future progress of chemistry. Electricity is again the basis for this prospective logic. In an echo of Priestley, he notes that when investigating ‘the general laws by which [phenomena] are governed... we are lost in obscure, though sublime imaginations concerning unknown agencies’. But his faith in progress enables him to claim ‘there is every reason to believe’ ‘that they may be discovered’.⁵⁵ Davy makes electrical science an emblem of this progress, noting that ‘at the beginning of the seventeenth century’ chemists were merely concerned with ‘the dreams of alchemy’, ‘the philosopher’s stone, and the elixir of life’.⁵⁶ Such ‘dim and uncertain twilight... has been succeeded by the steady light of truth’, Davy declares, and turns for proof, to achievements in electricity: ‘the phenomena of electricity have been developed; the lightnings have been taken from the clouds; and lastly, a new influence has been discovered, which has enabled man to produce from combinations of dead matter effects which were formerly occasioned only by animal organs’.⁵⁷ For Golinski, Davy emphasises the connection between electricity and life because ‘the promise of knowledge of the fundamental processes of life... gave a god-like status to those who wielded them’.⁵⁸ Davy’s electrical examples, however, seem to complicate this prospective logic. His reference to electricity as a mysterious ‘new influence’, emphasises the obscurity of electricity’s operation, and his focus on the vitalising effect of galvanic phenomena indicates that such enlightened science is perhaps not far removed from the alchemical search for the ‘elixir of life’. Again, Davy’s remarks on the physiological operation of electricity contrast with the strict claims of his electrochemistry in inorganic matter.

In later investigations of electricity, Davy avoids such claims for its vital properties, focusing instead on the electrolysis of inorganic matter, and competing with rivals like John Murray in Edinburgh and Gay-Lussac in Paris for the right to claim accuracy and priority in the identification of chemical elements.⁵⁹ Davy’s step away from speculations about electricity and life suggests his acknowledgement that such speculations are always dangerously uncertain. In his chemical work Davy uses electricity as an experimental tool, but never attempts to explain its operation.⁶⁰ As Fullmer notes, ‘while he recognised that the pile behaviour cloaked

a “mystery”, he wisely chose not to speculate on it. Instead he treated the action of the galvanic pile as something that could be understood without recourse to ideas which contradicted his view of how the natural world worked.⁶¹ At times of strain, though, Davy does bemoan his ignorance of the operation of electricity. Following the death of his friend Gregory Watt he notes in a letter, ‘We are masters of the earth, but perhaps we are the slaves of some great and unknown beings... We suppose that we are acquainted with matter, and with all its elements, and yet we cannot even guess at the cause of electricity.’⁶² In the pages of his textbook, the *Elements of Chemical Philosophy* (1812), Davy articulates his frustration at the obscurity of electricity in a different manner, building on his early critique of fluid models of electricity to declare:

With regard to the great speculative questions, whether the electrical phenomena depend upon one fluid...or upon two different fluids...or whether they may be particular exertions of the general attractive powers of matter, it is perhaps impossible to decide in the present imperfect state of our knowledge. The application of electricity as an instrument of chemical decomposition, and the study of its effects, may be carried on independent of any hypothetical ideas concerning the origin of the phenomena; and these ideas are dangerous only when they are confounded with facts.⁶³

Given electricity’s obscure causes, and the lack of adequate models of its operation, Davy notes, we have to focus on its effects in a laboratory context ‘as an element of chemical decomposition’ only. Davy’s Bakerian lecture of 20 November 1806 too, in which he clinches his claims for galvanism as a chemical tool by announcing his isolation of the element potassium, also avoids speculation about the electrical operation of the pile, treating it as a tool for his chemical work only.⁶⁴ He notes, ‘In the present state of knowledge, it would be useless to attempt to speculate on the remote cause of the electrical energy... its relation to chemical affinity is, however, sufficiently evident.’⁶⁵ Though he insists on experimental precision, and on electricity’s experimental utility, Davy also emphasises its occult operation. Morus suggests that for Davy, electricity ‘heralded the emergence of a new, rational and secular power associated with political emancipation and human progress’.⁶⁶ But electricity remains a problem for Davy because its occult causes leave a conceptual gap at the heart of his experimental practice.

Despite Davy’s focus on inorganic chemistry, his electrical work proves important for several contemporary discussions of vitality. As Ruston notes,

Davy characterised his work in 1800 as ‘lead[ing] to the door of the temple of the mysterious god of Life’.⁶⁷ But as he drew back from speculation about electricity, so he also discouraged theories of electrical vitality. Ruston discusses Davy’s membership of the Animal Chemistry Society, formed in 1812, a conservative body which aimed to show that vitality ‘could not be reduced to or explained by chemistry’, because its causes were divine.⁶⁸ Davy joined the Society ten years after his visionary statements in his *Essay* and his ‘Discourse’, which perhaps suggests his increasing conservatism. But alternatively, the attempts of the Animal Chemistry society to police the limits of the science of chemistry and electric vitality can be read as acknowledgement of the capacity of both discourses to resist such categorisation. Davy’s work continues to acknowledge electricity’s resistance to analysis. In his *Elements of Chemical Philosophy* he declares that ‘The laws of dead and living nature appear to be perfectly distinct: material powers . . . are merely the instruments of a superior principle.’⁶⁹ But just four years earlier in a Royal Institution lecture ‘Introductory to Electro-Chemical Science’, he had articulated a different view, acknowledging the futility of seeking definitive answers to such questions:

Life appears to us through sensible phenomena; but the powers concerned in its operations, must for ever be hidden. To apply the laws of common matter to organized structures, is seeking the living amongst the dead – looking for the ruler amidst slaves. That which sees, will not be visible; – that which touches, will not be felt; – that which commands sensations, will not be their subject.⁷⁰

In this lecture Davy focuses his attention on the electrical nature of chemical affinity, and does not seek answers to the obscure questions of vitality.⁷¹ But he remained fascinated by such questions until the very end of his life, suggesting in 1829 ‘that animal electricity will be found of a distinctive and peculiar kind’ from common electricity.⁷² Many of Davy’s contemporaries are not content to rest ignorant of the vital operations of electricity, however, and they use his galvanic electrochemistry as the basis of investigations of animal electricity and the ‘vital spirit’.

2 JOHN ABERNETHY, WILLIAM LAWRENCE AND MARY SHELLEY

Davy’s galvanic electrochemistry was a crucial element of Abernethy and Lawrence’s debates over the nature of vitality in the late 1810s, and also informs Mary Shelley’s treatment of the question of vitality in

Frankenstein. Marilyn Butler claims in her introduction to the novel that it ‘acts out the debate between Abernethy and Lawrence, in a form close enough for those who knew the debate to recognise’.⁷³ But Davy’s work is an equally crucial element of such discussions, and it complicates critics’ tendency to align Shelley’s discussion of the principle of life to either Lawrence’s or Abernethy’s position. In *Frankenstein*, Shelley harnesses the obscurity of electrical vitality in Davy’s work to complicate the binary distinction between the two sides of the vitality debate.

In 1814, Abernethy delivered his ‘Introductory Lectures, Exhibiting Some of Mr. Hunter’s Opinions Respecting Life and Diseases’ to the Royal College of Surgeons. Abernethy expands on the account of life by John Hunter with which Thelwall takes issue in 1793. Hunter had argued that ‘the principle of life cannot arise from the peculiar modification of matter, because the same modification exists where this principle is no more . . . Life, then, appears to be something superadded to this peculiar modification of matter.’⁷⁴ Abernethy follows Hunter in considering vitality to be ‘superadded’ to matter.⁷⁵ He concludes that as there are living entities with no material features in common in their structures, life must be independent of those structures:

What . . . is the natural inference to be drawn from the examination of this great chain of being, which seems to connect even man with the common matter of the universe? What but that which Mr Hunter drew, that life must be something independent of organization; since it is able to execute the same functions with such diversified structure, and even in some instances with scarcely any appearance of organization at all?⁷⁶

Abernethy departs from Hunter in a couple of important ways. As his reference to the ‘great chain of being’ suggests, he emphasises the spiritual implications of this debate. But surprisingly, given his sense of the theological significance of the discussion, Abernethy also makes it his task to identify the ‘something’ superadded to matter to make it live.

That ‘something’, for Abernethy, is electricity. In contrast to Davy who refrains from speculation on the nature of electricity, Abernethy set out how electricity acts on the body as a principle of vitality. In support, he cites Hunter’s work, noting: ‘Mr Hunter doubtless thought, and I believe most persons do think, that in magnetic and electric motions, a subtile invisible substance, of a very quickly and powerfully mobile nature, puts in motion other bodies which are evident to the senses, and are of a nature more gross

and inert.⁷⁷ As the *Edinburgh Review* was later to note, Hunter makes no such claims for the operations of electricity, but Abernethy's characterisation of the electric fluid as 'a subtle invisible substance' undetectable by the senses matches other contemporary accounts.⁷⁸ In the absence of empirical evidence this connection between electricity and vitality can only be proved by analogy, but Abernethy cites electricity's 'invisible', 'mobile' qualities as sufficient grounds for naming it as the vital principle:

Taking it for granted that the opinions generally entertained concerning the cause of electrical motions are true, analogy would induce us to suppose, that similar motions might be produced by similar causes, in matter organized as it is found to be in the vegetable and animal systems.⁷⁹

Abernethy extends his analogy to compare organic and inorganic structures, and strengthens his claims, declaring that 'The phaenomena of electricity and of life correspond. Electricity may be attached to, or inhere, in a wire; it may be suddenly dissipated, or have its powers annulled, or it may be removed by degrees in portions . . . So life inheres in vegetables or animals.'⁸⁰ Davy is very cautious about extrapolating the operations of electricity in metals and inorganic compounds to make claims for its function in organic matter. Abernethy is more confident, claiming a 'correspondence' between electricity's operation in organic and inorganic matter.

Despite these contrasts between Davy's and Abernethy's work, Abernethy turns to Davy for proof of his claims.⁸¹

The experiments of Sir Humphry Davy . . . form an important link in the connexion of our knowledge of dead and living matter. He has solved the great and long-hidden mystery of chemical attraction, by showing that it depends upon the electric properties which the atoms of different species of matter possess . . . That electricity is something, I could never doubt; and, therefore . . . it must be everywhere connected with those atoms of matter, which form the masses that are cognizable to our senses; and that it enters into the composition of every thing inanimate or animate. If then it be electricity that produces all chemical changes . . . analogy induces us to believe that it is electricity, which also performs all the chemical operations in living bodies; that the universal chemist resides in them.⁸²

Though Abernethy makes Davy his 'source' he collapses the distinction between the operation of electricity 'in dead and living matter' that Davy

works hard to preserve, calling to mind the uncertain provenance of galvanic forces. Abernethy is able to do so because he emphasises ‘the great and long-hidden mystery of chemical attraction’. Though Abernethy like Davy articulates a narrative of progress, his exploitation of Davy’s work demonstrates that the ‘mystery’ within Davy’s electrochemistry has not been eradicated. The operations of electricity are still obscure, and thus open to Abernethy’s speculations.

While Davy refuses to speculate on the nature of electricity, Abernethy makes it the active agent in various natural phenomena: ‘it is electricity which causes the whirlwind, and the water-spout, and which “with its sharp and sulphurous bolts splits the unwedgeable and gnarled oak,” and destroys our most stabile [sic] edifices . . . it is electricity which . . . makes the firm earth tremble, and throws up subterraneous matter from volcanoes’.⁸³ Though he is writing in the second decade of the nineteenth century, Abernethy’s account echoes eighteenth-century accounts of the electric fluid. He makes the grand, inexplicable operation of electricity in natural phenomena evidence of its operation within the body. ‘When . . . we perceive in the universe at large, a cause of rapid and powerful motions of masses of inert matter, may we not naturally conclude that the inert molecules of vegetable and animal matter, may be made to move in similar matter, by a similar cause?’⁸⁴ Abernethy’s account of a vital spirit ‘superadded’ to inert matter echoes much older discourses on the relation between body and soul. The perennial nature of Abernethy’s claims for electricity are also clear when he remarks that ‘Mr Hunter’s Theory is verifiable’ because ‘a subtile substance of a quickly and powerfully mobile nature, seems to pervade every thing, and appears to be the life of the world’.⁸⁵ This reference to ‘the life of the world’ evokes the set of associations between electricity and aether, and the ancient discourse of the *anima mundi* or soul of the world discussed in [Chapter 2](#). Abernethy makes these connections explicit:

The experiments of Sir H. Davy seem to realize the speculations of philosophers, and to verify the deductions of reason, by demonstrating the existence of a subtile, active, vital principle, pervading all nature as has heretofore been surmised, and denominated the Anima Mundi. The opinions which in former times were a justifiable hypothesis, seems to me now to be converted into a rational theory.⁸⁶

For Abernethy electricity is not a material vital principle but a spiritual ‘anima mundi’, and somewhat bizarrely, he uses Davy’s work to assert that

conceptions of the ‘anima mundi’ have become a ‘rational theory’.⁸⁷ Ruston notes that ‘Abernethy’s interpretation of these findings must have surprised Davy’.⁸⁸ But while Abernethy certainly misappropriates Davy’s work, there is a sense in which he identifies tensions in Davy’s account of the connection between electricity, matter and life. For Abernethy, Davy transforms older debates about vitality into a modern ‘rational theory’, but his mystical account of electricity also emphasises the occult qualities of Davy’s work.

Abernethy makes a further intervention in the debate over the connections between electricity, chemistry and life in the second of his 1814 lectures. He characterises the vital powers of electricity as follows:

If the vital principle of Mr Hunter be not electricity, at least we have reason to believe it is of a similar nature, and has the power of regulating electrical operations. That electricity is the great chemist both in organized and unorganized bodies, will be generally credited; and that the power which combines may also prevent decomposition, is too obvious to need discussion.⁸⁹

Abernethy assigns electricity an agency that we do not see in the first lecture, personifying it as ‘the great chemist’. Again he makes life an independent, quasi-spiritual, external quality, and in assigning electricity the identity of the chemist, recalls Davy and even seems to amalgamate him with his electrical tools. But Abernethy’s figurative alignment of electricity with chemistry is a complex move. In his 1817 ‘Physiological Lectures’ he amends the personification, asserting that ‘this chemist, Life, has the power of regulating the temperature of the substances in which it resides’.⁹⁰ Life, rather than electricity is the independent source of agency here, but this agent is characterised in both cases as a chemist. Within ten years of Abernethy’s pronouncement, Richard Carlile makes electricity a ‘great chemist’ in service of a very different political argument. But for both commentators electrical vitality is fundamentally connected with chemical processes.

Abernethy’s account of electrical vitality met with derision. An *Edinburgh Review* article of September 1814 noted that while chemistry seemed an appropriate means of investigating vitality, physiological actions ‘are accomplished solely by the operation of those affinities which regulate chemical combination among particles of matter in general’.⁹¹ Thus Abernethy had misinterpreted both Hunter’s and Davy’s work.⁹² The

lectures ‘are a collection of bad arguments, in defence of one of the most untenable speculations in physiology; interspersed with not a little bombast about genius, and electricity’.⁹³ The *Edinburgh* especially criticises Abernethy’s outmoded account of electricity, which misrepresents Davy’s work. ‘If there be any man who believes, that Sir Humphry Davy has done all this, or who has suffered himself to be so borne away by these “whirlwinds” and “water-spouts” of Mr Abernethy, as to look upon his body as a Leyden phial, we fear that we should exhaust our vital principle in endeavouring to dispel the illusion.’⁹⁴ But in addition, the article suggests the absurdity of naming the vital principle, which is ‘an agent, about which nothing is known’.⁹⁵ Investigators might make use of speculation, but this should be based on experiment and observation. William Lawrence’s response to Abernethy echoes much of the criticism set out by the *Edinburgh*, but his account proves much more controversial.

In his lectures published as the *Introduction to Comparative Anatomy and Physiology* (1816), Lawrence sets out his comparison of human anatomy with that of other species. In the second lecture he considers the ‘organization and life’ of animals and declares that ‘the life is the result of the organization’ and should always be studied alongside it.⁹⁶ Though Lawrence speaks warmly of Abernethy, he refutes his claim that life is ‘independent’ of organisation, arguing that it results from physical structures of organic bodies. Lawrence’s lectures met with enormous hostility from Abernethy and his supporters, who charged him with being one of a school of ‘modern sceptics’, who threatened religious, moral and social order.⁹⁷ In his *Lectures on Physiology, Zoology, and the Natural History of Man* (1819), which respond to Abernethy’s attacks, Lawrence strengthens his claims for the material basis of life, and more explicitly criticises Abernethy’s electrical vitalism. Lawrence does not deny the possibility of an electrical form of life, but he critiques the way Abernethy collapses the distinction between organic and inorganic forms. Like Davy, however, Lawrence finds that electricity complicates the distinction between organic and inorganic structures.

In his *Lectures on Physiology* Lawrence eviscerates Abernethy’s ‘electrochemical doctrine of life’ and in doing so reveals interesting fault lines in contemporary conceptualisations of electricity itself.⁹⁸ Lawrence notes that Abernethy’s claims lack proof, whereas there is plentiful evidence for his own:

I never met with even the shadow of a proof that the contraction of a muscle or the sensation of a nerve depended in any degree on electrical

principles . . . On the other hand, I see the animal functions inseparable from the animal organs; – first shewing themselves, when they are first developed; coming to perfection as they are perfected; – modified by their various affections; – decaying as they decay; and finally ceasing, when they are destroyed.⁹⁹

Lawrence aims to restrict theories of life to the results of such observable evidence. ‘To talk of life as independent of an animal body; to speak of a function without reference to an appropriate organ, is physiologically absurd. It is in opposition to the evidence of our senses and rational faculties.’¹⁰⁰ He rejects Abernethy’s suggestion of the social and theological significance of an electrical vital spirit, and insists that rather than making him a ‘sceptic’, such empirical observation is the more theologically sound approach because Abernethy’s work suggests a blasphemous amalgamation of the spiritual and the material.¹⁰¹

The theological doctrine of the soul, and its separate existence, has nothing to do with this physiological question, but rests on a species of proof altogether different. The sublime dogmas could never have been brought to light by the labours of the anatomist and physiologist. An immaterial and spiritual being could not have been discovered amid the blood and filth of the dissecting-room; and the very idea of resorting to this low and dirty source for a proof of so exalted and refined a truth, is an illustration of . . . the powerful bias that professional habits and the exclusive contemplation of a particular subject, give even to the strongest minds.¹⁰²

Like Davy, Lawrence attempts to limit the implications of the debate over vitality. In Abernethy’s account, electricity resists categorisation, and is assigned a spiritual as well as material function. Lawrence ridicules Abernethy’s suggestion that ‘this subtile and mobile vital fluid is brought forward . . . not only . . . to shew the nature and operation of the cause, by which the vital phenomena are produced, but to add a new sanction to the great principles of morals and religion, and to eradicate all the selfish and bad passions of our nature’.¹⁰³ Lawrence aims to close down the interpretive possibilities of electrical vitality, as they can be mobilised against him. He attempts to fix the interpretations of electricity itself; it is not a spiritual phenomenon but a material one, and therefore if he could subscribe to an electrical theory of life, such a theory would reinforce his materialist principles: ‘For subtile matter is still matter; and if this fine stuff can possess vital properties, surely they may reside in a fabric which differs

only in being a little coarser.’¹⁰⁴ In rejecting the spiritual qualities of vital electricity, Lawrence restricts his focus to material causes and effects.

Lawrence does address the means through which investigators might explain the mystery of vitality, and like Davy and Abernethy, he suggests that the science best suited to the task is chemistry, or animal chemistry, ‘lying between the domains of chemistry and physiology’.¹⁰⁵ Lawrence investigates the limits of ‘animal chemistry’, asking

whether the vital processes can be explained on the same principles as the other phenomena of matter; whether, in short, the elucidations of the physical sciences are equally applicable to the science of life . . . whether any living phenomena can be so far likened to those of electricity, galvanism, magnetism, as to justify us in referring for their explanation to the same principles.¹⁰⁶

Lawrence interrogates the ‘analogy’ on which Abernethy’s claims are based, stressing that chemistry is the tool through which to do so. He concludes that Abernethy’s ‘analogy’ between the operation of electricity in inorganic structures and in living bodies is untenable. He declares, probably in a reference to Davy, that

the ablest chemists . . . are extremely cautious in applying it to the explanation of vital processes . . . Living bodies, as well as all dead ones, exhibit electrical phenomena under certain circumstances: but the contrast between the animal functions and electric operations is so obvious and forcible, that the attempts to assimilate them do not demand further notice.¹⁰⁷

Lawrence correctly identifies Davy’s caution, though perhaps overstates the rigour with which Davy distinguishes between electricity’s organic and inorganic functions. Abernethy’s approach, for Lawrence, is nowhere near as systematic. His analogy is unsupported by evidence and thus shifts from philosophical comparison to imaginative figure of speech. In Abernethy’s work ‘we quit the path of observation, and wander into the regions of imagination and conjecture. It is the poetic ground of physiology; but the union is unnatural, and, like other unnatural unions, unproductive.’¹⁰⁸ For Lawrence, chemistry demonstrates that electrical researches and physiology should not be mixed:

The science of organised bodies should . . . be treated entirely differently from those which have inorganic matter for their object . . . Although

organised bodies are subject in many respects to physical laws, their own peculiar phenomena present no analogy to those which are treated in chemistry . . . and other physical sciences: the reference to gravity, to attraction to chemical affinity, to electricity and galvanism, can only serve to perpetuate false notions in physiology.¹⁰⁹

Such statements produce a devastating critique of Abernethy, but despite their polemical power, the distinction between ‘organised bodies’ and ‘inorganic matter’ is not as stable as Lawrence would like. As Davy’s work hints, galvanic chemistry offers evidence that vital electricity might bridge the divide between these two forms of matter. Indeed, as Ruston notes, Lawrence’s lectures work against their own attempts to fix meaning: ‘vitality is typified by its ability to move and transmute; it is constantly changing and attempts to bind and fix it are perceived as fatal’.¹¹⁰ Despite his demolition of Abernethy’s ‘electro-chemical theory of life’, Lawrence’s work does not eradicate the possibility that electricity is obscurely connected with vital properties. Mary Shelley takes up this suggestion in her account of the animation of Victor Frankenstein’s creature in the 1818 edition of *Frankenstein*.

Davy’s use of chemistry is a crucial element of Shelley’s account of life in the first edition of *Frankenstein*. While this engagement with Davy’s work may have resulted initially from Percy Bysshe Shelley’s interest in electrical science, his work lies beyond the scope of this chapter and I focus instead on the textual connections between *Frankenstein* and Davy’s, Abernethy’s and Lawrence’s work.¹¹¹ Laura Crouch notes the rhetorical connections between Davy’s writings and the declarations of Victor Frankenstein and his teachers, noting that Davy’s claims for the scope of chemistry in his 1802 ‘Discourse’ seem to be echoed in the novel.¹¹² In a celebrated passage, Davy declares of chemistry:

By means of this science man has employed almost all the substances in nature . . . Not contented with what is found upon the surface of the earth, he has penetrated into her bosom, and has even searched the bottom of the ocean for the purpose of allaying the restlessness of his desires, or of extending and increasing his power. He is to a certain extent ruler of all the elements that surround him, and he is capable of using not only common matter according to his will and inclinations, but likewise of subjecting to his purposes the ethereal principles of heat and light.¹¹³

As Crouch suggests, Davy’s words do not anticipate the detail of Victor’s achievements in the novel, but they anticipate the ‘enthusiasm’ and

‘scientific optimism’ by which he is driven.¹¹⁴ Such ‘enthusiasm’ is certainly evident in the words of Professor Waldman, Victor’s teacher at Ingolstadt. Describing the work of chemists, Waldman declares:

These philosophers, whose hands seem only made to dabble in dirt, and their eyes to pour over the microscope or crucible, have indeed performed miracles. They penetrate into the recesses of nature, and shew how she works in her hiding places. They ascend into the heavens; they have discovered how the blood circulates, and the nature of the air we breathe. They have acquired new and almost unlimited powers; they can command the thunders of heaven, mimic the earthquake, and even mock the invisible world with its own shadows.¹¹⁵

Waldman echoes Davy’s claims for the scope of chemical science, which includes the investigation of vitality. And this rhetorical connection between Davy and Victor seems to have been clear to Shelley’s contemporaries. A playbill for Richard Brinsley Peake’s *Presumption*, the first stage adaptation of *Frankenstein* in 1823, echoes Davy’s claims in the *Discourse*: ‘*The striking moral exhibited in this story, is the fatal consequence of that presumption which attempts to penetrate, beyond prescribed depths, into the mysteries of nature.*’¹¹⁶

But the importance of Davy’s work for the novel goes beyond these rhetorical connections. Davy’s argument for the cultural and intellectual reach of chemistry, and his account of the complex operation of electricity in chemical science, are echoed in Victor’s declaration in chapter three of the novel, that in Ingolstadt ‘natural philosophy, and particularly chemistry, in the most comprehensive sense of the term, became nearly my sole occupation’.¹¹⁷ Chemistry ‘in the most comprehensive sense of the term’ informs Victor’s practice, in particular his engagement with electricity. Shelley’s use of Davy’s work enables her also to engage with the Abernethy–Lawrence controversy. Her appropriation of the science of electricity in the novel complicates any binary distinction between ‘Frankenstein the blundering experimenter . . . [who] shadows the intellectual position of Abernethy . . . and Lawrence’s sceptical commentary on that position’.¹¹⁸ Readings of the novel which make it a polarised account of Lawrence and Abernethy’s positions tend to narrow the interpretive possibilities suggested in Shelley’s laconic account of the creature’s animation. Victor Frankenstein is not merely a blunderer, after all he succeeds, and to read the novel as merely a satire of Victor’s and Abernethy’s work

might be to lose sight of other important questions raised by this scene, in particular Shelley's account of electricity.

In subtitling her novel *The Modern Prometheus* Shelley gestures to the association between electricity and Promethean vital forces suggested in the work of Graham, Robinson and Darwin. The key moment for *Frankenstein's* use of electricity is Victor's animation of the creature in at the opening of volume one, chapter four:

It was on a dreary night of November, that I beheld the accomplishment of my toils. With an anxiety that almost amounted to agony, I collected the instruments of life around me, that I might infuse a spark of being into the lifeless thing that lay at my feet. It was already one in the morning; the rain pattered dismally against the panes, and my candle was nearly burnt out, when by the glimmer of the half-extinguished light, I saw the dull yellow eye of the creature open; it breathed hard, and a convulsive motion agitated its limbs.¹¹⁹

This account of the creature's animation is shockingly brief, but Shelley's short paragraph adeptly exploits the obscurity of electrical science by suggesting several, perhaps mutually exclusive, possibilities for the science of the creature's creation. According to contemporary discussions, Victor could be administering a galvanising electrical shock in the manner of Aldini, or evoking the more occult properties of nervous or 'animal' or 'vital' electricity championed by Abernethy to create the same effect. Shelley's phrase 'spark of being' assumes complex significance here; it could be a material, electric 'spark' or a more figurative exploitation of the Promethean association between electricity and the 'vital principle'. The 'spark' might not relate to electricity at all, but to some other property of the organisation of the creature. Victor's application of the 'spark of being' to his creature does not necessarily suggest vitalist methodology. It could also refer to materialist understandings of 'organisation' in the manner of Lawrence.

Many critics join Butler in aligning Victor with Abernethy's vitalist position, and reading the novel as a satirical 'rejection of spiritual vitalism'.¹²⁰ Butler notes that 'Frankenstein's "instruments of life" capable of infusing the "spark of being" suggest the galvanic battery used in real life to try to bring a poisoned cat or hanged criminal back to life.'¹²¹ Such readings offer a particular interpretation of the electrical science of the novel. They literalise Abernethy's 'analogy' between electricity and life,

and compare it with the contemporary experiments of showmen like Aldini and later Andrew Ure, who in 1818 ‘animated’ executed felons in Glasgow.¹²² The key phrase for these readings is Shelley’s ‘spark of being’. For Ruston, ‘there is much evidence to support the idea that the “spark of being” with which Frankenstein “infused” the creature was electricity’, whereas Crouch declares ‘surely this “spark” refers to a life force closely related to electrical power’.¹²³ The first reviews of *Frankenstein* also discuss Victor’s means of animating the creature, and while Walter Scott in the *Edinburgh Magazine* focuses on his manipulation of the creature’s ‘organised form’, John Wilson Croker in the *Quarterly* condemns the ‘enthusiasm’ by which he is led ‘to study the structure of the human frame, and to attempt to follow to its recondite sources “the stream of animal being”’.¹²⁴

Such consensus seems supported by the evidence of the novel itself. While Shelley gives little away in the animation scene, earlier references to Victor’s education suggest the galvanising power of electricity. Croker, perhaps unwittingly, gestures to this connection with the phrase from his *Quarterly Review* piece, ‘the stream of animal being’. Croker apparently misquotes Shelley, as the phrase does not appear anywhere in the novel. But it does align closely with a discussion of electricity in the opening chapter of *Frankenstein*, in which Victor witnesses ‘a most violent and terrible thunder-storm’:

I remained, while the storm lasted, watching its progress with curiosity and delight... I beheld a stream of fire issue from an old and beautiful oak, which stood about twenty yards from our house; and so soon as the dazzling light vanished, the oak had disappeared, and nothing remained but a blasted stump. When we visited it the next morning, we found the tree shattered in a singular manner. It was not splintered by the shock, but entirely reduced to thin ribbands of wood. I never beheld anything so utterly destroyed.¹²⁵

The ‘catastrophe of the tree’ stimulates Victor’s interest in ‘the nature and origin of thunder and lightning’. His father informs him that they are electrical, and the pair recreate experiments with ‘a small electrical machine’ including the kite experiment of Franklin.¹²⁶ Neither Victor nor his father make any connection between the lightning storm’s ‘stream of fire’ and the electric vital spirit, but Croker seems to do so in his phrase ‘stream of animal being’, demonstrating the ease with which the two discourses are connected.

Later, while at Ingolstadt, Victor is exposed to the contrasting practices of his two teachers, Krempe and Waldman. Inspired by a combination of their teaching and his early alchemical reading, Victor applies himself to the novel's fundamental question: 'Whence, I often asked myself, did the principle of life proceed?'¹²⁷ Victor never names electricity in his account of his research or of his eventual breakthrough. At his moment of epiphany he gestures to the importance of organised form in the manner of Lawrence, and to gradual processes of decay and resurrection rather than instantaneous animation.

I saw how the fine form of man was degraded and wasted; I beheld the corruption of death succeed to the blooming cheek of life; I saw how the worm inherited the wonders of the eye and brain. I paused, examining and analysing all the minutiae of causation, as exemplified in the change from life to death, and death to life, until from the midst of this darkness a sudden light broke in upon me – a light so brilliant and wondrous, yet so simple, that while I became dizzy with the immensity of the prospect which it illustrated.¹²⁸

But Shelley does not use Lawrence's work in any straightforward way. Victor's flash of inspiration, the 'sudden light' that 'broke in upon me', seems to allude to the galvanisation of his mental faculties, and his construction of the creature's body as 'a frame for the reception of [life]' implies that the vital spirit is something 'superadded', as Abernethy claims. Victor's statement that he garners the 'spark of being' to infuse it into 'the lifeless thing that lay at my feet', also suggests that life and organisation are separable. With this mixed series of engagements with electrical science, Shelley refuses explicit reference to galvanism in any form in the 1818 edition of the novel. She suggests instead that the gothic obscurity of Victor's undertakings arises from the mystery of the operations of electricity itself.

The open-endedness of Shelley's representation of the creature's animation in the 1818 edition of the novel is thrown into starker relief by contrast with her revised 1831 edition. In her 'Author's Introduction' (1831) Shelley claims that when she conceived the novel in 1818 the reanimation of dead matter was a real scientific possibility, and she implies that this informed her narrative: 'Perhaps a corpse would be re-animated; galvanism had given token of such things: perhaps the component parts of a creature might be manufactured, brought together, and endued with vital warmth.'¹²⁹ The 1818 text itself, though, does not include any explicit

reference to galvanism.¹³⁰ Shelley's claims in 1831 for the origins of the novel are entirely distanced from the 1818 text; critics have noted what Butler terms the introduction's 'exaggerated, sensationalized diversion[s]' which play down the radical implications of the narrative.¹³¹ Shelley's naming of Victor's science as galvanism in 1831 can be read as part of the effort, as Hetherington puts it, to revise 'her early work in order to dissociate it from Lawrence'.¹³² By naming one scientific context for her discussion of animation, the spectacular but suspect showmanship of Aldini, Shelley attempts to foreclose the radical interpretive openness of electrical science in the first edition of *Frankenstein*.

In the 1810s, electricity relates to life in many more complex ways than in Aldini's spectacular experiments. Shelley signals the complexity which animates but is never resolved by the work of Davy, Abernethy and Lawrence, in her use of the term 'spark of being'. This 'spark' may signify, as Croker in the *Quarterly Review* suggests, an electric 'stream of fire' like that which destroys the oak in chapter one of *Frankenstein*. But two contrasting uses of the phrase 'spark of being' in contemporary accounts suggest much more complex and troublesome associations between electricity and life. In a sermon published in 1794, the evangelical preacher Samuel Davies declares to his congregation:

A few years ago you were nothing. But at the creative fiat of the Almighty, that little spark of being, the soul, was struck out of nothing; and now it warms your breast, and animates the machine of flesh. But shall this glimmering spark . . . ever be extinguished? No; it will survive the ruins of the universe, and blaze out into immortality.¹³³

In Davies's account, the 'spark of being' refers to the soul. As in Abernethy's work, an immaterial soul and physiological vitality are intimately connected, as this 'spark' is described in sensual terms of warmth and light, and is nonetheless immortal, and divinely imparted from God. But just six years later in *Phytologia* (1800), Erasmus Darwin discusses reproduction in plants and animals, declaring:

Every new fluid or solid produced in the organic system of vegetable or animal bodies is secreted from their blood . . . Amongst these are . . . the *flavilla vitae*, the new spark of being or living entity, [which] is also secreted from the blood of male animals by adapted glands to be received into a proper nidus, and nourished by the female.¹³⁴

For Darwin, the ‘spark of being’ has no divine provenance; it is a ‘living entity’ produced by organic processes of reproduction. In Lawrence’s terms, vitality here is a product of organisation, but nonetheless the quality of being alive rather than dead is described by Darwin as a ‘spark’. These two examples seem to articulate irreconcilable conceptions of the ‘spark of being’, but Shelley evokes both in her animation scene, and suggests that it would be a mistake to close down either possibility for the vital operation of electricity.

In *Frankenstein*, Shelley exploits the obscurity of the connections between electricity and vitality to ensure that the key to Victor’s animation of the creature cannot be read with certainty. As Victor notes to his companion Walton, ‘I see by your eagerness, and the wonder and hope which your eyes express, my friend, that you expect to be informed of the secret with which I am acquainted; that cannot be: listen patiently until the end of my story, and you will easily perceive why I am reserved upon that subject.’¹³⁵ But beyond the demands of her plot, Shelley suggests the futility of efforts by Lawrence or Abernethy to come to a certain conclusion about the nature of vitality. She seems closer to Davy’s claims in allowing Victor to make use of an apparently electric vital force as a tool, without attempting to explain it. But through this connection between electricity and animation Shelley demonstrates the gothic obscurity at the heart of Davy’s narratives of the progress of electrical science. The radical openness of the science of the novel suggested by such a reading of electricity chimes with deconstructionist readings of *Frankenstein* such as that of Fred Botting, who insists on the novel’s radical ‘indeterminacy’, declaring ‘The quest to uncover the secret of the text’s nature, to unfold once and for all its living presence, its principle of life, does not reveal the unequivocal or authorised voice, but discloses only monstrous doubles, different and distant from any unifying figure’.¹³⁶ Botting warns against the critical urge to classify and taxonomise the text, and does so using an image which returns to the animation scene. A focus on electricity enables a similar claim for the novel, but starts in a different way from the animation scene. That scene is the moment in the novel where Victor’s engagement with the science of electric vitality reaches its apotheosis. These contemporary accounts of the vital properties of electricity produce the radically open science of the novel. Victor’s use of chemistry ‘in the most comprehensive sense of the term’ promises him the tools to make sense of such occult vitality, but his work demonstrates the obscurity at the heart of Davy’s electrochemistry.

3 RICHARD CARLILE

The radical publisher Richard Carlile made an important intervention in the controversy over the vital properties of electricity and the cultural and political significance of chemistry in the late 1810s. Carlile was a self-taught radical journalist and publisher, a former tin worker who made his name in the radical agitation that followed the end of the Napoleonic Wars. In his journal *The Republican* (1819–1825) and shorter publications like *An Address to the Men of Science* (1821) Carlile stressed a stridently anticlerical form of republicanism, which was strongly informed by his study of electricity and chemistry. Carlile had received no formal education, but as Joel Wiener has noted the doctrine of self-improvement for both himself and his readers was crucial to his rhetoric.¹³⁷ Carlile seized on the way in which chemistry and electricity were potentially accessible to all, being cheap to practise and possible to develop outside of formal institutional structures. Carlile inserted himself into Abernethy and Lawrence's dispute over electricity and life when Lawrence's 1819 lectures were found by the Chancellor Lord Eldon to be 'seditious'. Carlile offered to publish the lectures at his own risk of prosecution, thereby presenting Lawrence as a 'martyr' to superstition and corruption, alongside Galileo, and also Carlile himself.¹³⁸ Here I build on the work of Ruston and others to think about the significance of Carlile's connections with Lawrence for his understandings of electricity and matter. However, the focus of my discussion is Carlile's connections not with Lawrence but with Davy, whose electrochemistry proved a crucial influence for Carlile's claims for the nature of electricity and matter.¹³⁹

The doctrine of matter that Carlile learned and developed through his chemical and electrical studies in turn fuelled the anticlerical and atheist claims of his publications. He declares in the *Republican* that 'The principles of Materialism are truly Republican, and the principles of Republicanism are truly material, as the only principles that will give happiness and prosperity to the human species.'¹⁴⁰ Though his religious views undergo a series of shifts throughout the 1820s and 1830s, he remains a committed opponent of the established church in Britain, in particular its resistance to the discussion of theological ideas.¹⁴¹ Carlile's materialism, atheism and republicanism set him at odds with contemporary radical spokesmen like Henry Hunt and William Cobbett, and unlike them he was not an orator; his long imprisonment for blasphemous libel after 1819 ensured his reliance on the printed word to communicate with

his followers. Nonetheless Carlile's work had an important influence on radical culture in the late 1810s. His *Republican* had a huge readership, peaking at a weekly figure of fifteen thousand in the autumn of 1819, dwindling to two thousand before its closure.¹⁴² This readership spanned the nation, but was concentrated in the industrial cities of the Midlands, Yorkshire and Lancashire, and as Wiener notes comprised artisans and tradesmen including 'in large numbers, tailors, masons, printers, shoemakers, carpenters, and other craftsmen'.¹⁴³ This 'culture of the artisans' as E. P. Thompson terms it, demonstrated the capacity to shift from support to activism after Carlile's incarceration and that of his family in Dorchester gaol, as many workers who did not know Carlile volunteered to keep his shop and publishing business open.¹⁴⁴

Historians have noted the influence of Carlile's strong interest in science on his artisan readership. Both Wiener and Adrian Desmond stress the 'impetus' Carlile gave to popular interest in science, and note how his insistence on the 'socially regenerative properties of materialistic science and . . . utopian belief in its liberalizing force' influenced radical and reformist calls for the levelling of political hierarchies and the reform of ecclesiastical power in the 1820s and early 1830s.¹⁴⁵ But such accounts tend to focus on the later period of Carlile's career with the establishment of the Rotunda radical lecture and meeting house in 1830, or to offer a very broad account of the term 'science' which assumes Carlile's immersion in and diffusion of 'infidel' and materialist doctrines arising out of late eighteenth-century enlightened radical texts such as C. F. Volney's *Ruins of Empire* and Baron d'Holbach's *System of Nature*, alongside Thomas Paine's *The Age of Reason*.¹⁴⁶ Carlile was deeply influenced by these texts, and determined to circulate them more widely, even at the cost of prosecution. His interest in the nature of matter also seems to have been stimulated by d'Holbach's work in particular.¹⁴⁷ But Carlile's activism was not catalysed solely by this generation-old materialist discourse of enlightenment. Rather, his writings demonstrate that he took an intense interest in the contemporary, groundbreaking work being undertaken in chemistry and in electrical experimentation. Humphry Davy was thus a crucial interlocutor for Carlile, whose influence has yet to be fully discussed.¹⁴⁸

Jon Klancher has begun this work by discussing the dialogue and dispute between Davy and Carlile's conception of the purpose of chemical science. Klancher notes the break between the chemistry of the early nineteenth century and earlier natural philosophical research, citing Davy as the inspiration for Carlile's 'striking, and for his time, original

case that what the post-1800 sciences purvey is . . . a new “materialism”, a picture of the universe dissolving and recreating in a ceaseless flow of material processes’.¹⁴⁹ Klancher stresses the conservatism of Davy’s institutional backing, methods and conclusions, and notes that Carlile’s appropriation of his work exposes ‘the contradiction between Davy’s practical materialism and his proclaimed neo-aristocratic idealism at the Royal Institution’.¹⁵⁰ I build on Klancher’s insight here, to suggest that Carlile’s use of Davy’s electrochemical work lays bare that ‘contradiction’ and demonstrates the mysteries and uncertainties at the heart of that work. While Carlile aims to claim electricity as a symbol of enlightened progress, the meaning of electrical language in his works seems to slip, signifying instead something more obscure and more violent. Though he distrusts imaginative play and metaphorical language, Carlile uses a figurative discourse of electrical vitality in order to support his political arguments. Carlile’s claims for the importance of science for understandings of political as well as natural structures had an important effect on later developments in artisan education. In the 1820s, though, he articulates a uniquely strong and detailed engagement with electrical science, which arms him with a form of rhetoric that is distinct from those of radical contemporaries like Hunt or Cobbett. Carlile argues that the necessity of reform is evident in the nature of matter itself. But like Davy, Abernethy, Lawrence and Shelley, he finds that electrical discourse complicates and destabilises his polemical statements.

Carlile’s 1819 trial and prosecution for blasphemous libel for the publication of Paine’s *The Age of Reason* and Elihu Palmer’s *The Principles of Nature* was a high-profile media event, reported in over eighteen newspapers, and attracting comment from a range of correspondents in Britain and abroad.¹⁵¹ In his defence at the trial, Carlile argues for the necessity of free discussion, noting Paine’s own interest in scientific matters, and arguing ‘that when free discussion on all subjects, political or theological, literary or scientific, shall be tolerated, that then, and then only, will the human mind, by progressive improvement, arrive at that state, which may be deservedly termed THE AGE OF REASON’.¹⁵² And after his imprisonment, from his cell in Dorchester, Carlile presents his printing press as the agent of improving ‘free discussion’. Like many radical commentators, Carlile advocates progress through communication, but he finds that celebrations of the progress enabled by such communication are both catalysed, and complicated, by a language of vitality. Critics tend to characterise Carlile’s valorisation of

print communication as an index of his commitment to enlightenment and progress, but his celebration of communication is less discerning than this. At the end of his career he writes: ‘My nature is a circulating one, it hoards nothing, is pained by secrets, and wants the human mind as open as the human face.’¹⁵³ Carlile’s praise of communication of all kinds and at all costs, demonstrates a strategic deployment of different communicative methods for different purposes, some in support of a narrative of rational progress, but others harnessing iconoclastic, even violent methods. As he notes in the *Republican*:

The writings of a few friends to the happiness of mankind, assisted by a connection with the American Revolution, roused the latent spark of liberty in the bosom of the then degraded and oppressed French nation, and effected prodigies of valour. The contagion has reached almost every country in Europe, for those things are contagious, and every monarch finds it necessary to prop his throne with bayonets and the most corrupt practices.¹⁵⁴

Carlile’s praise of the ‘spark of liberty’ here is not a hymn to enlightened progress; it draws on the idea of political communication as rapid, instinctive and contagious. Throughout the *Republican* Carlile appropriates the shifting significance of the language of chemistry and electrical vitality. He offers a strategically partial reading of chemistry as the most far-reaching and rational science, and of electricity as a symbol of materialist thought enabling ecclesiastical and political reform. But his claims also demonstrate the more unruly implications of electrical communication. Unlike his predecessors in the 1790s Carlile rarely claims the salutary effects of communication described in terms of electrical vitality. Instead, his account of electricity and matter suggests that material processes operate on a sublime scale, beyond any human control, and that the political forces he seeks to animate share the same properties.

When he discusses his scientific education, Carlile emphasises his autodidact status, offering himself as a model for his readers. In both the *Republican* and *Address to the Men of Science*, he claims that his own mastery of the principles of chemistry and physiology demonstrates their democratic essence. Carlile emphasises the radical implications of contemporary accounts of matter, noting in the *Republican* volume one:

That man has no soul, or no immortal part, may be proved to demonstration . . . Matter itself is imperishable, and wherever matter exists,

vegetation and animation will exist also. It is the vanity and arrogance of man in attempting to account for . . . the first cause that has produced so many idle stories and creeds, which have distracted and destroyed the fairer part of the creation on this orb.¹⁵⁵

Carlile maintains these views throughout subsequent volumes of the *Republican*, noting in volume six in 1822: ‘The discovery of the gaseous principle of matter has scientifically annihilated every idea of spirit. The whole universe and every thing contained in it is proved to a certainty to be material.’¹⁵⁶ This has explicitly anticlerical implications, but also suggests, for Carlile, that all religious and political orthodoxies should be and can be subject to interrogation, even by those lacking formal education.

Carlile’s rationalist rhetoric has led James Epstein to emphasise his ‘rigorous appeal to openness and clarity of rational expression’. Carlile’s, Epstein notes, ‘was a profoundly democratic and essentially utopian vision of communication conditions . . . where nothing but the persuasive force of rational argument would prevail among equals dedicated to the pursuit of truth and mutual improvement’.¹⁵⁷ Epstein emphasises Carlile’s suspicion of figurative expression in political communication, and notes his antipathy to imaginative writing, especially poetry.¹⁵⁸ This antipathy is evident in Carlile’s private correspondence as well as his published works; writing to William Vamplew Holmes he declares: ‘I look at all rhyming as a trifling with common sense and I am of opinion that as mankind become more enlightened the thing will be left off.’¹⁵⁹ But despite Carlile’s distrust of poetry, his figurative use of the language of chemistry and electricity in the *Republican* complicates Epstein’s suggestion that ‘the language of science was . . . the ultimate expression of reason – transparent, antimetaphorical, universal’.¹⁶⁰ Carlile does at times yoke scientific and political progress in the *Republican*, declaring that ‘The present is an age of revolution . . . All written and pretended revelations . . . must fall before the better knowledge of society, and every place of worship be converted into a TEMPLE OF SCIENCE.’¹⁶¹ But he complicates his own embargo on figurative language by employing frequent images of physical violence, noting in his journal *The Deist*:

An awful contest has commenced, which must terminate in the destruction of thrones and civil despotism . . . or . . . intellect, science, and manly virtue, will be crushed in one general ruin, and the world will retrograde towards a state of ignorance, barbarism, and misery. The latter however is an event

rendered almost impossible by the discovery of the art of printing, by the expansion of mind, and the general augmentation of knowledge.¹⁶²

Carlile argues for the inexorable progress of reason, and for the importance of his own communicative practices. But he makes it a physical as well as an intellectual ‘contest’; despite his confidence for its outcome, Carlile’s martial language suggests a violent cost to both sides. Though Carlile finds great polemical purchase in appeals to reason, he also deploys other tactics, and even his celebration of the progress of science acknowledges the limits of our knowledge. These limitations and uncertainty enable him to articulate less confident, more troubled aspects of his political aims and identity, but ultimately, to make the case for the inexorability of future progress.

Carlile thus finds polemical purchase in the languages of chemistry and electricity as peculiarly modern sciences, which exemplify both the progress of reason and the pervasive conceptual gaps in scientific investigation. Their obscurity does not invalidate Carlile’s appeals to reason, but provides rhetorical impetus for his more visionary predictions of the political future. In his Preface to the *Republican*, Carlile appeals to science as an agent of progress, but one whose effects are iconoclastic, and violent:

My warfare is with error and delusion of all kinds, particularly that which . . . has a tendency to degrade my countrymen, by becoming a bar to the sciences and civil improvements . . . It is science, the parent of all that can render life desirable or worth preserving, that has been the devil in the Christian Religion. Science is that innovation so much deprecated by the interested adherents to that religion. Science has been continually at war with it . . . Science is the Antichrist. Let the shade of GALILEO speak to this: – let the living LAWRENCE speak.¹⁶³

In this discursive ‘warfare’, progress can only be guaranteed at the expense of Christianity, making science the ‘Antichrist’. Carlile supports these apparently wild claims with historic and contemporary examples of religious persecution of scientific thought, and this is the first of several occasions on which he compares Lawrence’s ‘persecution’ by the Royal College of Surgeons with that of Galileo and the Inquisition.¹⁶⁴ For Carlile, progress in the sciences is not the inevitable outcome of the progress of reason; the sciences are entrenched in religious and political interests, which must be overcome through efforts such as those he later proposes in his *Address to the Men of Science*.¹⁶⁵

At times Carlile declares chemistry and electricity ‘the most important among the sciences’, and evidence of rational progress.¹⁶⁶ In volume three of the *Republican* he notes:

We must look to those two sciences as the main engine for the annihilation of superstition, and as the key to all the secrets of nature. They . . . require the fostering hand of a liberal and enlightened nation and government, and in a few years they would reach something like perfection: though like nature itself they would be infinite, and researches and discoveries would never cease. It is this that makes science delightful, that there is always room for further improvement, and the mind that delights in it, might never be dull and unoccupied, but kept in a continual exercise.¹⁶⁷

Carlile’s account pulls in interestingly contradictory directions. Both chemistry and electricity are evidence of secularising modernity and progress, but they are nowhere near ‘perfection’. Carlile claims that ‘something like perfection’ is possible with appropriate institutional support, but also suggests the ‘infinite’ scope of electricity and chemistry will keep human ingenuity in ‘continual exercise’, evading comprehensive understanding. Electricity and chemistry are both emblems of human reason and evidence of its limitations, retaining mysteries that cannot be resolved. They enable a powerful rhetoric of potentiality for Carlile, but, as in Davy’s work, retain an obscurity which complicates his appeals to reason.

A similar logic plays out in Carlile’s account of electricity in volume two of the *Republican*. He repeats his admission that he is an autodidact, declaring that ‘I have never made any experiments in electricity nor seen them made by others: all that I know of it I have gathered from books and conversation.’¹⁶⁸ But nonetheless the science of electricity is accessible to him, particularly now, as ‘since I have been in this prison, having a part of the Oxford Encyclopaedia, which treats on the article *Electricity*, I have read it over’.¹⁶⁹ Based on his reading, Carlile makes confident claims about electricity. He is unashamed of the rudimentary level of his engagement, emphasising the democratic qualities of electrical science whose mysteries are potentially accessible to all.

I have no fear myself, but that a few persons who would set earnestly about an inquiry into the subject . . . they would soon explode the far famed laws of gravitation introduced by Newton. It appears that the most important discoveries in philosophy and natural history are to be made by the most simple means.¹⁷⁰

Carlile represents his own understanding of electricity and the science in general as in a basic state, but capable of perpetual improvement:

The knowledge of the phenomena of the electric fluid appears to me to be in its infancy. I am of opinion, that in this all the grand secrets of nature are to be discovered, that in this we may trace the cause of light, of heat, of animal, and of vegetable life. It is to this part of science that I would wish to direct the attention of the most eminent philosophers.¹⁷¹

Carlile makes multiple, overlapping claims for the status of electrical science. It is a symbol of the progress of knowledge, and of the limitations of human understandings of the world. He again makes the obscurity of electricity enabling. It allows him to speculate, to assign electricity a vital function, and also to assert that the study of it is structured by a prospective, progressive logic. Carlile is alert to the political implications of scientific rhetoric, and does not hesitate to use electrical imagery to describe his practice, but such language retains the complexities and vagaries of his understanding of electricity itself.

Carlile's use of electrical imagery complicates Epstein's claims that the *Republican* privileged 'rationalist discourse over meaning structured around... metaphor or metonymy'.¹⁷² His use of such images instead illustrates the instability of 'rationalist discourse' in the physical sciences, and the political uses to which that instability can be put. Carlile appropriates the language of electrical science to make political claims in *The Republican*, exploiting its yet-to-be-achieved discoveries in order to make similar predictions for the political order. In the first issue, he asserts that 'The Boroughmongers are well aware that the magical voice of truth and common sense, though uttered by a few uninstructed mechanics, is making the most rapid and electrifying progress through the minds of every man in Britain.'¹⁷³ Carlile makes electricity a communicative medium for 'the magical voice of truth and common sense', a voice which like electricity can be claimed as both rational and occult. But he also plays on electricity's vitalising properties, making it a catalyst of the political action he calls for in the autumn of 1819. This language thus enables Carlile to make claims for future progress, which retain an implicit suggestion of instinctive communication, even violence. Such mixed significations are clear in a *Republican* article from December 1819 which praises the political and religious infidelity 'gathering force, and rapidly communicating from breast to breast, like an electrical shock'.¹⁷⁴ Again, electricity is

an enabling medium of iconoclastic political ideas, the means through which even the imprisoned Carlile can experience a sense of solidarity. But this communication is not reasoned and measured but rather combustible and painful.

The potential violence of electrical communication thus makes it a useful image of the physical struggle inherent in Carlile's political project. He exploits the violent unpredictability of 'the electric fluid' as an image for the violence he suggests is inherent in radical agitation. He asserts in the week after the Peterloo massacre of August 1819: 'Englishmen! This is the exact state of things under which you exist . . . your enemies have taken the alarm and are on the alert – prepare and strike at them. Let your voice come round them like the rolling thunder, and let your indignation flash on them, as the destructive fluid of the terrific lightning.'¹⁷⁵ Even at moments of relative calm in 1820 Carlile returns to such imagery to evoke the imminent threat of uprising: 'The political hemisphere increases its gloom: the gases of misery and oppression are dangerously predominant in its atmosphere; and unless the electric fluid be carefully separated, and withdrawn by some skilful conductor, an explosion becomes inevitable.'¹⁷⁶ Electricity again represents popular violent uprising. Carlile calls for a skilled political leader on the lines of Davy's electrical investigator, to act as a lightning rod and dispel the threat.

The violence of electrical imagery in the *Republican* also shades into more complex and positive claims. In October 1819 Carlile anticipates 'a verdict of Not guilty' in his trial for blasphemous libel. Such a verdict, he predicts, 'will strike [Despotism] to the ground with the force of an electric fluid, and like a violent whirlwind, tear it up root and branch'.¹⁷⁷ But in the same article he declares that the verdict

will destroy the remains of ignorance and superstition, and establish the liberty of the press and free discussion with all its genial influence – will give life to the literary and philosophic world, which alone can perfect society – will re-animate the drooping virtue and morality of the country with more than usual health and vigour.¹⁷⁸

In this piece electricity is not only a destructive force but also a vitalising one. Carlile seems to echo earlier reformist writings whose appeals to vitality emphasise the salutary effects of electricity, and by extension, of political reform. Electrical vitality indeed becomes a favourite image for Carlile in later volumes of the *Republican*. He declares of revolution in

Italy, ‘the spirit of liberty is like the electric fluid – it is one and the same thing: it is the life of man’.¹⁷⁹ Describing uprisings in Spain he notes ‘Liberty is like the electrical fluid, it invigorates whatever living substance it pervades’.¹⁸⁰ Carlile’s polemical use of images of electrical vitality in fact contradicts his views on vitality recorded in his *Observations on ‘Letter to a Friend on the Evidences, Doctrines, and Duties of the Christian Religion’* (1821), where Carlile follows Lawrence, making vitality ‘the consequence of an organized frame capable of breathing the atmospheric air’, but noting that as air is ‘a compound substance, it is difficult to say what, or whether, any particular part of it forms the vital principle’.¹⁸¹ But Carlile intuitively grasps the crucial importance of vitalised images of political communication, especially when describing European agitations for political reform. He suggests that just as Burke feared in 1796, this vital spirit enables an ‘electrick communication every where’, which does not recognise national borders, but activates the innate capacity for liberty in every human breast.

Carlile makes adept use of the figurative complexities of electrical language in the *Republican*. His only regret is that not enough reformers are sufficiently well informed about chemistry and electricity to draw similar connections between these sciences and political activism.¹⁸² While, as Desmond has shown, the artisans and workers who made up Carlile’s readership did indeed develop a thriving culture of scientific investigation in the mid-1820s, earlier in the decade, such activity had yet to begin, and Carlile urges it into life.¹⁸³ The cowardice of scientific men dating back to Newton, Carlile suggests, means that science has not reached its rightful audience, and he makes it his task to popularise such findings.¹⁸⁴ He declares in volume two of the *Republican*: ‘I look on...[every] natural globe of matter to be A GREAT CHEMICAL APPARATUS, constantly composing and decomposing various substances, and, like the human body, subject to eruption, explosions, and ebullitions, in consequence of the overflowing or confined inflammable matter which is created in it.’¹⁸⁵ But though he frequently articulates his chemical view of the world in the *Republican*, Carlile demands a more systematic articulation of the chemical operation of matter and its significance for understandings of political society. In 1821 he publishes his *Address to the Men of Science; Calling Upon Them to Stand Forward and Indicate the Truth from the Foul Grasp and Persecution of Superstition*, followed by a second edition in 1822. Carlile articulates two related aims in the *Address*: he outlines in more detail his understanding of the nature of

matter, and the importance of chemistry in enabling such understanding, and he urges ‘men of science’ to ‘stand forward’ as Lawrence had done, to articulate the radical implications of their researches.

As in the *Republican*, Carlile stresses his unlearned status: ‘I am not myself a man of experimental Science, neither, out of the ordinary occupation of my past life, have I ever seen a scientific experiment made in any one department of Chemistry, or Natural Philosophy; all that I know . . . has been acquired by reading and meditation.’¹⁸⁶ He genuflects before the expertise of ‘men of science’ but also suggests that such knowledge is accessible to all. Carlile expands his claim in the *Republican* for the importance of chemistry, declaring: ‘As matter and motion comprise every thing we can behold or conceive, and as Chemistry is an investigation of the properties of matter . . . it is evidently the most important part of science, or rather, the first and last part of it.’¹⁸⁷ Carlile seems to draw on Davy’s claims for the scope of chemistry, but unlike Davy, he emphasises chemistry’s radical qualities. He praises ‘the advancements made in Science’ and singles out

Our Chemists [who] have proved themselves the greatest of all revolutionists, for they have silently and scientifically undermined all the dogmas of the priest . . . Every species of matter has been brought to dissolution, and its elementary properties investigated, by their crucibles and fires, or their galvanic batteries, and we have been practically and scientifically shewn in what manner Nature performs her dissolutions and regenerations.¹⁸⁸

Carlile recruits chemistry to a celebratory narrative of scientific progress, which supplies evidence for his thesis that ‘Science is the Antichrist’. But with his reference to ‘galvanic batteries’ the content and tone of Carlile’s argument shift. He notes:

As far as I understand, but one phenomenon of nature remains unexplained, and that is the properties of the electric fluid . . . I do not despair of this being reached, and I have the strongest hope, as it will lead at once to a knowledge of the cause of our existence, and that of every animal and vegetable substance. It will shew the cause and process by which inert matter becomes organised, and how all the variegated beauties of nature start into life.¹⁸⁹

This reference to electricity undermines Carlile’s claims for the totalising view of the chemist, as it is still a mystery which resists the ingenuity of the

‘man of science’. Carlile adeptly navigates this problem, by stressing the vitalising properties of electricity itself, and like Davy stresses the prospective qualities of electrical science with its inevitable future discoveries. But throughout the *Address*, Carlile returns to electricity as a mystery and a problem, complicating any simple celebratory narrative of rational progress.

In the second edition of the *Address*, Carlile celebrates the way in which chemistry unmasks the ‘priestly imposture’ that humans have a soul.

The Chemist can analyse the body of man, and send it into its primitive gaseous state in a few minutes. His crucible and fire, or his galvanic battery, will cause it to evaporate so as not to leave a particle of substance or solid matter, and this chemical process is but . . . a hastening of the workings of Nature; for the whole universe might be aptly termed a great chemical apparatus, in which a chemical analysis, and a chemical composition is continually and constantly going on.¹⁹⁰

Carlile extends his claim in the *Republican* that the earth is ‘A GREAT CHEMICAL APPARATUS’, to the workings of the universe. As Klancher notes, for Carlile as for Davy the chemist is the master of this universe, mimicking and controlling natural forces by manipulating matter in its various states.¹⁹¹ But Carlile’s reference to electrochemistry forces him to add a disclaimer to this triumphalist rhetoric. In a footnote, he cites an anecdote that demonstrates both the power and the mystery of the electric fluid. Carlile describes a lightning storm that struck ‘a vessel called the Susan, on the voyage from New Brunswick to Demerara’:

The dangerous fluid struck the vessel with terrible force . . . and shattered the main-top-mast and jib-boom into splinters. It also burst the ship on the starboard bow . . . One of the crew was, in a manner, annihilated by the fluid, no mark remained of him but blots of his blood on the sails and rigging. The rest were more or less hurt by the fall, when the mast and rigging came down . . . There is a doubt hanging on this account whether the man was struck overboard or dissolved, gaseated, or evaporated, by the power and force of the electric fluid.¹⁹²

This account demonstrates the violently destructive power of electricity; like the oak tree in chapter one of *Frankenstein* the ship and sailor are ‘utterly destroyed’. This seems to stop Carlile’s rhetoric in its tracks, compromising his claims that men of science will soon master this great

mystery, and throwing into question his celebration of the resistless march of reason. But such mystery does not seem to be a problem for Carlile. In the *Address* he repeatedly and deliberately seeks out such examples of the power of electricity and the limits of human knowledge.

Carlile makes a similar move when he asserts in the *Address*:

Matter never was created – matter never can be destroyed. There is no superior power: it has no rival. It is eternal both as to the past and future. It is subject to a continual chemical analysis, and as continual new composition. For a full comprehension of these assertions, it is necessary to have a knowledge of the elements of Chemistry.¹⁹³

He directs non-specialist readers who might require a knowledge of chemistry to ‘Mr Parke’s [sic] Chemical Catechism, or Dr Ure’s Chemical Dictionary, [which] will explain all my assertions on the properties of matter’.¹⁹⁴ But again the operations of electricity compromise Carlile’s narrative of rational progress in the sciences. Carlile’s Dr Ure is the Andrew Ure whose galvanisation of executed corpses in Glasgow in 1818 may have influenced Mary Shelley. In his dictionary entry on electricity, Ure emphasises its obscurity: ‘Concerning the nature of the electrical essence, we are equally in the dark, as concerning the nature of caloric. The phenomena may be referenced in both cases, either to a peculiar fluid... or to a peculiar affection of the molecules of common matter’.¹⁹⁵ Ure does not attempt to analyse the imponderable electrical fluid. He focuses instead on his spectacular galvanic experiments, and notes how when the influence was applied to the corpse ‘every muscle in his countenance was simultaneously thrown into fearful action; rage, horror, despair, anguish, and ghastly smiles, united their hideous expression in the murderer’s face, surpassing far the wildest representations of a Fuseli or a Kean’.¹⁹⁶ Again Carlile’s reference to electricity diverts his account from a celebration of reason to an encounter with the gothic obscurities of electrical science.

Carlile even makes electricity the subject of his last word in the second edition of the *Address*, breaking off from a jubilant account of the success of his attempts ‘to establish the right of free discussion on all subjects’.¹⁹⁷ In his closing lines Carlile admits that ‘the properties of that [electric] fluid are still unexplored’, though he asserts that ‘a variety of experiments are making upon that point, which it is hoped may... give the final blow to superstition all over the world’.¹⁹⁸ Carlile’s repeated references to the

work still to be done in electrical science demonstrate that his support for the transmission of scientific ideas arises from more than a desire to court controversy and unsettle religious feeling. Research in electricity provides Carlile with a uniquely mobile means through which to articulate his political aims. Though he argues for the march of reason, electricity's mysterious operations equip him with rhetoric that incorporates both millennial claims for the political future, and threats of the violent effects of continued repression.

Carlile supports his scientific claims in the *Republican*, the *Address* and *Observations* with reference to contemporary researchers, in particular Lawrence and Davy. While Lawrence is usually cited as an example of heroic martyrdom or regrettable capitulation, Carlile's representation of Davy's work is more complex.¹⁹⁹ In contrast to Abernethy, Carlile does not rework Davy's galvanic researches to support his own claims. Instead, he intuits and deploys the dual significance of Davy's work, in which electricity is both the tool of scientific progress and an obscure mystery. In the *Address*, Carlile cites Davy to support his claims for the revolutionary effects of chemical science, declaring:

This is an age of revolutions . . . Throughout Europe the mind of the people has been long revolutionized from its wonted ignorance, and wherever it finds an opportunity, it displays itself. This march of the mind will be progressive, and it is evident that it has already begun to spread itself among the very instruments of those despots called Kings.²⁰⁰

In support of this claim, Carlile tells how the 'imbecile idiot' Emperor of Austria expressed 'horror' at 'the progress of Science, and at the revolution which Sir Humphry Davy has made in the science of chemistry'.²⁰¹ Carlile seems to deliberately seek to embarrass Davy here; though the two men share a faith in the progress of science, Davy never articulates such progress in terms of political revolution, and Carlile extrapolates the radical implications of chemical investigation far beyond anything we find in Davy's works.

Carlile offers a more subtle reading of Davy's work in the *Observations*. He moves beyond a celebration of progress and seems to identify the uncertainty in Davy's electrochemical work. Carlile notes that 'Science is but yet in its infancy . . . It now rises gloriously upon the decay of Superstition and Priestcraft, and since the putridity of that soil could not destroy it, it will find a stimulus to its growth from the corrupt matter

which has been thrown around it.²⁰² As in the *Address*, Carlile uses Davy as an example of this progress: ‘very important discoveries are taking place daily, through the science of chemistry, and . . . Sir Humphrey [sic] Davy has . . . produced what has been called a revolution in the science’.²⁰³ Carlile exploits the term ‘revolution’, knowingly making Davy his revolutionist, but he also gives an account of Davy’s electrochemistry that complicates any narrative of rational progress. Like Mary Shelley, Carlile identifies the obscure qualities of electricity which elude attempts to taxonomise it.

There is another principle connected with matter . . . of which I have but a very faint idea, and which, I understand, has yet eluded all research as to its private properties, and which, in my humble opinion, when unfolded, will unfold with it much of what we now call the secrets of Nature, namely – the electric fluid, and the part it acts in animals, in vegetables, in solid, or in gaseous matter.²⁰⁴

Carlile’s confident statements are replaced by a series of hedging clauses, as he attempts to articulate the chemical operation of the ‘electric fluid’. In contrast to the *Address*, Carlile makes no claims that the ‘properties’ of the electric fluid will be imminently discovered; it has ‘set at defiance every attempt hitherto made to get at a true definition of it’.²⁰⁵ The purpose of this passage is different; Carlile suggests that his fascination with electricity arises not from the way it enables claims for progress, but from the way in which, even in Davy’s electrochemistry, its obscure operations enable speculation. Carlile is in speculative mode here as he suggests that electricity ‘acts in animals, in vegetables, in solid, or in gaseous matter’. He undoes the distinction between organic and inorganic matter that Lawrence and Davy try to police. The operations of electricity cannot be limited, Carlile suggests, to a particular kind of matter; it plays a part in all the ‘secrets of Nature’. Electricity in this account is both occult and sublime, and these qualities give enormous power to the electrical metaphors of his political writings.

Carlile’s publications of the late 1820s and 1830s exhibit less focus on the latest developments in chemistry and electricity, though his influence is heard in the way his protégée and second wife Eliza Sharples sustained the connection between electricity, vitality and reform in a series of lectures at Carlile’s Rotunda in 1832. Sharples notes that the body is ‘a self-acting electrical machine’ in which electricity enables ‘pulsation, sensation and the general circulation of the system’; and stresses the

importance of this materialist vision for theories of education and social cohesion.²⁰⁶ Though he does not engage with electricity himself in print, Carlile's intrigue with the mysteries of electricity is clear to the very end of his life. In the early 1840s he develops a fascination with animal magnetism, and ever with his eye on progress, celebrates his acquisition in 1842 of a galvanic battery, 'very simple in its construction', for the benefits it might offer his increasingly lame body; Carlile carried out electric treatments on his muscles but also looked to more futuristic technology, noting: 'I wait for a locomotive carriage from this power'.²⁰⁷ Though he appeals to reason and progress, Carlile intuits the uncertainties of electrical science. In a similar fashion to Shelley, and even Davy, Carlile faces, analyses and appropriates those mysteries, in order to make his case for future political and clerical reform. Despite the systematising efforts of Davy, Lawrence and other contemporaries, then, electricity retains its obscurity and its ready translation into figurative expressions in the 1810s and 1820s. Understandings of matter enabled by Davy's electrochemistry demonstrate the progress of the sciences, but they also offer a model for Shelley's and Carlile's sense of the radical mystery of communication and vitality in physical and political bodies.

NOTES

1. Knight, *Humphry Davy*, 40; Fulford, 'Man Electrified Man', 192–193.
2. 'On the electricity excited by the mere contact of substances of different kinds. In a letter from Mr Alexander Volta', in Davis, ed., *Science in the Making*, 36. Volta's letter was published in French in *Philosophical Transactions* in June 1800, and translated into English for the *Philosophical Magazine* in December of that year.
3. *Ibid.*, 37.
4. *Ibid.*, 45.
5. *Ibid.*, 47.
6. Lilley, 'Nicholson's Journal', 84.
7. Nicholson, 'Account', 183; Mertens, 'Shocks and Sparks', 307–308; Sudduth, 'The Voltaic Pile', 26.
8. Priestley, *History and Present State*, 463.
9. Pancaldi, 'On Hybrid Objects', 249.
10. Golinski, *Public Science*, 253.
11. Lilley, 'Nicholson's Journal', 84–85.
12. *Ibid.*, 91. See also Knight, *Humphry Davy*, 40.
13. Golinski, *Public Science*, 206–207.

14. *Morning Chronicle*, 30 May 1800.
15. Golinski, *Public Science*, 205–206, 208; Fullmer, *Young Humphry Davy*, 304.
16. Knight, *Humphry Davy*, 40; Thomas, ‘Sir Humphry Davy’, 156.
17. Davy, *Collected Works*, vol. IV, 37.
18. Davy, *Collected Works*, vol. VIII, 284; Hofmann, *André-Marie Ampère*, 203.
19. Pancaldi suggests that it was Beddoes who may have steered Davy away from physiological and towards chemical concerns in Bristol, ‘On Hybrid Objects’, 256–257.
20. Pancaldi, ‘On Hybrid Objects’, 250.
21. Golinski, *Public Science*, 223.
22. *Ibid.*, 189.
23. Unwin and Unwin, ‘Devotion to the Experimental Sciences and Arts’, 182.
24. Golinski, *Public Science*, 217, 235; Klancher, *Transfiguring the Arts and Sciences*, 129.
25. Golinski, *Public Science*, 243.
26. Jacyna, ‘Immanence or Transcendence’, 312.
27. Ruston, *Shelley and Vitality*, 6, 17. See also Jacyna, ‘Immanence or Transcendence’, 321–322.
28. Shelley, *Frankenstein*, 32.
29. Golinski, *Public Science*, 243.
30. Fulford, ‘Man Electrified Man’, 194. See also Golinski, *Public Science*, 9.
31. John Davy, in Davy, *Collected Works*, vol. II, 4. See also Shelley, ‘Author’s Introduction’, 197.
32. Golinski, *Public Science*, 204.
33. Davy, ‘An Account of Some Experiments on the Torpedo’, 15; Golinski, *Public Science*, 205.
34. Davy, ‘An Account of Some Experiments on the Torpedo’, 275.
35. Thomas, ‘Sir Humphry Davy’, 145.
36. Davy, ‘Additional Experiments on Galvanic Electricity’, 328; Fullmer, *Young Humphry Davy*, 299.
37. Davy, ‘Notice of Some Observations’, 341; Fullmer, *Young Humphry Davy*, 307.
38. Fullmer, *Young Humphry Davy*, 301, 311.
39. Davy, ‘Letter to Mr Nicholson’, 527.
40. *Ibid.*
41. Fullmer, *Young Humphry Davy*, 316.
42. *Ibid.*, 409, 206.
43. Davy, *Collected Works*, vol. VIII, 270.
44. Aldini, *Account of the Late Improvements*, 6, 53; Morus, ‘Radicals, Romantics’, 268.
45. *The Times*, 22 January 1803, 3; Morus, ‘Radicals, Romantics’, 269–270.
46. Morus, ‘Radicals, Romantics’, 269.

47. Davy, 'An Account of the Late Improvements', 196.
48. Davy, *Collected Works*, vol. II, 311; see Crouch, 'Davy's *A Discourse*', 36.
49. Davy, *Collected Works*, vol. II, 313.
50. *Ibid.*, 314.
51. *Ibid.*, 222.
52. *Ibid.*, 31–32.
53. *Ibid.*, 41, 82. See also Levere, *Affinity and Matter*, 44.
54. Davy, *Collected Works*, vol. II, 84–86.
55. *Ibid.*, 320.
56. *Ibid.*, 320–321.
57. *Ibid.*, 321.
58. Golinski, *Public Science*, 200.
59. Davy, *Collected Works*, vol. IV, 114–115; Golinski, *Public Science*, 214, 219, 225–232; Crosland, *Gay-Lussac*, 75–82.
60. I follow Golinski in suggesting that the Voltaic pile is a reassuringly reliable tool for Davy, but stress that the causes of its operation remain obscure. Golinski, *Public Science*, 202.
61. Fullmer, *Young Humphry Davy*, 316.
62. Davy to William Clayfield, 21 October 1804, <http://www.davy-letters.org.uk/>.
63. Davy, *Collected Works*, vol. IV, 128. See also Davy, *Collected Works*, vol. I, 236–237; vol. VIII, 277; Ruston, *Creating Romanticism*, 163–164; Williams, *Michael Faraday*, 68–69; Levere, *Affinity and Matter*, 44.
64. Golinski, *Public Science*, 209; Knight, *Humphry Davy*, 62–63; Lilley, 'Nicholson's Journal', 86.
65. Davy, *Collected Works*, vol. V, 39–40.
66. Botting, *Making Monstrous*, 190.
67. Davy to Coleridge, 26 November 1800, <http://www.davy-letters.org.uk/>; Ruston, *Creating Romanticism*, 171.
68. Ruston, 'Resurrecting Frankenstein', 100; Levere, *Poetry Realized in Nature*, 53.
69. Davy, *Collected Works*, vol. IV, 127.
70. Davy, *Collected Works*, vol. VIII, 286.
71. *Ibid.*, 284.
72. Davy, 'Account of Some Experiments on the Torpedo', 17.
73. Butler, 'Introduction', xx.
74. Hunter, *Works of John Hunter*, vol. I, 221.
75. Abernethy makes more polemical claims for this 'superaddition' in his 1817 *Physiological Lectures*.
76. Abernethy, *Introductory Lectures*, 17; Butler, 'Introduction', xviii.
77. Abernethy, *Introductory Lectures*, 14.
78. 'An Inquiry into the Probability and Rationality', 394.

79. Abernethy, *Introductory Lectures*, 15.
80. *Ibid.*
81. Abernethy continues to make these claims in his 1817 lectures. Abernethy, *Physiological Lectures*, 26, 245, 247.
82. Abernethy, *Introductory Lectures*, 17.
83. *Ibid.*, 17. Abernethy cites *Measure for Measure* II, ii: ‘Merciful Heaven, / Thou rather, with thy sharp and sulphurous bolt, / Splits the unwedgeable and gnarled oak / Than the soft myrtle’. Shakespeare, *Measure for Measure*, 45–46.
84. Abernethy, *Introductory Lectures*, 18.
85. *Ibid.*
86. *Ibid.*
87. Abernethy makes a similar connection with ancient philosophy in his 1817 lectures. Abernethy, *Physiological Lectures*, 30.
88. Ruston, ‘Shelley and Science of Life’, 5; Ruston, *Shelley and Vitality*, 14.
89. Abernethy, *Introductory Lectures*, 30.
90. Abernethy, *Physiological Lectures*, 27.
91. ‘An Inquiry into the Probability and Rationality’, 389; Ruston, *Shelley and Vitality* 43–44.
92. ‘An Inquiry into the Probability and Rationality’, 396.
93. *Ibid.*, 384.
94. *Ibid.*, 397.
95. *Ibid.*, 391.
96. Lawrence, *Introduction to Comparative Anatomy*, 115, 117. See also Butler, ‘Introduction’, xix.
97. Abernethy, *Physiological Lectures*, 40. See Ruston, ‘Natural Enemies’, 71–73.
98. Lawrence, *Lectures on Physiology*, 6.
99. *Ibid.*, 6–8.
100. *Ibid.*, 59.
101. *Ibid.*, 14.
102. *Ibid.*, 8.
103. *Ibid.*, 11. Lawrence’s remarks here seem to anticipate those of the *Quarterly Review* article ‘Abernethy, Lawrence, etc.’, 110.
104. Lawrence, *Lectures on Physiology*, 84.
105. *Ibid.*, 59.
106. *Ibid.*, 69–70.
107. *Ibid.*, 76.
108. *Ibid.*, 82.
109. Lawrence, *Introduction to Comparative Anatomy*, 160–161.
110. Ruston, ‘Natural Enemies’, 79.
111. Hogg, *Life of Percy Bysshe Shelley*, 21, 34–35, 48–56; Ruston, *Shelley and Vitality*; Ruston, ‘Shelley’s Links’; Goulding, ‘Real Doctor Frankenstein?’; Wilson, *Shelley and the Apprehension of Life*.

112. Crouch, 'Davy's *A Discourse*', 35–36.
113. Davy, *Collected Works*, vol. II, 318.
114. Crouch, 'Davy's *A Discourse*', 36, 38.
115. Shelley, *Frankenstein*, 30.
116. Quoted in Forry, *Hideous Progenies*, 5.
117. Shelley, *Frankenstein*, 32.
118. Butler, 'Introduction', xx–xxi.
119. Shelley, *Frankenstein*, 38–39.
120. Butler, 'Introduction'; Crouch, 'Davy's *A Discourse*'; Hetherington, 'Creator and Created', 5; Ruston, 'Resurrecting Frankenstein', 99.
121. Butler, 'Introduction', xxx.
122. Morus, *Frankenstein's Children*, 130; Morus, 'Galvanic Cultures', 8.
123. Ruston, *Creating Romanticism*, 124; Crouch, 'Davy's *A Discourse*', 37; Joseph, 'Introduction', x; Hindle, 'Introduction', xxv.
124. Scott, 'Frankenstein', 250; Croker, 'Frankenstein', 379.
125. Shelley, *Frankenstein*, 24.
126. *Ibid.*, 24.
127. *Ibid.*, 33.
128. *Ibid.*, 34.
129. Shelley, 'Author's Introduction', 195–196.
130. Crouch, 'Davy's *A Discourse*', 338; Hetherington, 'Creator and Created', 1–2; Baldick, *In Frankenstein's Shadow*, 4.
131. Butler, 'Introduction', xxiii. See also Baldick, *In Frankenstein's Shadow*, 61–62.
132. Hetherington, 'Creator and Created', 5; Butler, 'Introduction', xxiii.
133. Davies, *Sermons on Important Subjects*, vol. II, 41.
134. Darwin, *Phytologia*, 91–92.
135. Shelley, *Frankenstein*, 35.
136. Botting, *Making Monstrous*, 3.
137. Wiener, 'Journalism of Richard Carlile', 77; Wiener, *Radicalism and Freethought*, 61.
138. Carlile celebrates Lawrence as a martyr, and regrets the suppression of his lectures, but also makes him his virtual tutor in scientific facts and methods. Carlile, *Observations*, 65. Carlile publishes Lawrence's lectures, advertising them for sale in *The Republican*, vol. V, 465, 512. He also seems to have corresponded with Lawrence in later years; he claims that Lawrence has sent £4 for the relief of his imprisoned shopkeepers. Carlile to William Vamplew Holmes, 25 August 1822, Huntington Library MSS. RC 362. Carlile also asked that on his death 'his body, if he died first, should be given to Mr Lawrence'. Holyoake, *Life and Character*, 27.
139. Ruston, 'Natural Enemies' 73, 80; Priestman, *Romantic Atheism*, 189–191; Epstein, *Radical Expression*, 127; Temkin, *Double Face of Janus*, 355.
140. Carlile, *The Republican*, vol. V, 57. See also Aldred, *Richard Carlile*, 87.

141. Carlile's protégé G. J. Holyoake gives a careful account of the evolution of Carlile's religious views in Holyoake, *Life and Character*, 24–25.
142. Wiener, 'Carlile and *The Republican*', 80.
143. Wiener, *Radicalism and Freethought*, 112–113.
144. Thompson, *Making*, 796.
145. Wiener, *Radicalism and Freethought*, 69, 112; Desmond, 'Artisan Resistance', 82.
146. Thompson, *Making*, 798; Desmond, 'Artisan Resistance', 82–83; Wiener, *Radicalism and Freethought*, 109–110.
147. Desmond, 'Artisan Resistance', 95. Desmond notes the polemical root to Carlile's championing of chemistry but stresses its anticlerical effects, *ibid.*, 94.
148. Wiener argues for the influence on Carlile of the electrical work of Richard Phillips, editor of the *Monthly Magazine* and 'much more of a quack than a scientist'. But references to Phillips in Carlile's work are more rare than those to Davy. Wiener, *Radicalism and Freethought*, 112.
149. Klancher, *Transfiguring the Arts and Sciences*, 128.
150. *Ibid.*, 130.
151. Carlile, *Report of the Proceedings*. Shelley wrote to Leigh Hunt on 3 November 1819 making a detailed case for Carlile's right to a retrial. Shelley, *Letters*, 136–148.
152. Carlile, *Report of the Proceedings*, 38, 58–65.
153. Carlile to Thomas Turton, 12 February 1840, Huntington Library MSS. RC 484.
154. Carlile, *The Republican*, vol. II, 115. See also Ruston, *Shelley and Vitality*, 64–65; Carlile, *Life of Thomas Paine*, vii.
155. Carlile, *The Republican*, vol. I, 228.
156. Carlile, *The Republican*, vol. VI, 219–220.
157. Epstein, *Radical Expression*, 112, 114, 119.
158. *Ibid.*, 112.
159. Carlile to William Vamplew Holmes, 10 April 1823, Huntington Library MSS. RC 368.
160. Epstein, *Radical Expression*, 124–125.
161. Carlile, *The Republican*, vol. II, 342–343.
162. Carlile, *The Deist*, 9.
163. Carlile, *The Republican*, vol. I, xiv.
164. See Carlile, *The Republican*, vol. VI, 256, 317–319. The third member of this persecuted triumvirate is Carlile himself; see Carlile, *Address to Men of Science*, 2nd edition, 110, 113, 117–118.
165. Klancher, *Transfiguring the Arts and Sciences*, 130.
166. Carlile, *The Republican*, vol. III, 232.
167. *Ibid.*

168. Carlyle, *The Republican*, vol. II, 302.
169. *Ibid.*
170. *Ibid.*
171. *Ibid.*, 301–302.
172. Epstein, *Radical Expression*, 117.
173. Carlyle, *The Republican*, vol. I, 9–10.
174. *Ibid.*, 295.
175. *Ibid.*, 6.
176. Carlyle, *The Republican*, vol. III, 145–146. Here Carlyle echoes Shelley's claim in the Preface to *Prometheus Unbound* that 'The cloud of mind is discharging its collected lightning, and the equilibrium between institutions and opinions is now restoring or is about to be restored.' Shelley, *Poetry and Prose*, 134.
177. Carlyle, *The Republican*, vol. I, 97.
178. *Ibid.*, 97–98.
179. Carlyle, *The Republican* vol. III, 472.
180. Carlyle, *The Republican* vol. IV, 379.
181. Carlyle, *Observations*, 44–45.
182. Carlyle, *The Republican*, vol. II, 339.
183. Desmond, 'Artisan Resistance', 83.
184. Carlyle, *Address to Men of Science*, 2nd edition, 101. Carlyle repeatedly castigates Newton's hypocrisy for not revealing his agnosticism; see Carlyle, *The Republican*, vol. II, 341.
185. Carlyle, *The Republican*, vol. II, 483–484.
186. Carlyle, *Address to Men of Science*, 2nd edition, 95.
187. *Ibid.*, 123.
188. *Ibid.*, 97.
189. *Ibid.*
190. *Ibid.*, 99–100.
191. Klancher, *Transfiguring the Arts and Sciences*, 129.
192. *Ibid.*
193. *Ibid.*, 112–113. See also *ibid.*, 97.
194. See Parkes, *Chemical Catechism*, 512; Ure, *Dictionary of Chemistry*.
195. Ure, 'Electricity' in *Dictionary of Chemistry*, n.p.
196. Ure, 'Galvanism' in *Dictionary of Chemistry*, n.p. Ure refers to the art of Henry Fuseli and the acting of Edmund Kean.
197. Carlyle, *Address to Men of Science*, 2nd edition, 137.
198. *Ibid.*
199. *Ibid.*, 110.
200. *Ibid.*, 110–111.
201. *Ibid.*, 112.
202. Carlyle, *Observations*, 67.

203. *Ibid.*, 68.
204. *Ibid.*, 70.
205. *Ibid.*, 71.
206. Sharples, 'An Inquiry', 85; Morus, 'Galvanic Cultures', 10. Sharples confirms in another *Isis* paper that this electrical theory of life is nonetheless materialist, noting: 'All electricity depends on certain arrangements of materials, without which it cannot exist; so that the imagination of life without the body, is like the creation of all things out of nothing.' Sharples, 'Fifth Discourse', 244.
207. Carlile to Thomas Turton, 11 April 1842, 8 December 1841, Huntington Library MSS. RC 522, RC 515; Wiener, *Radicalism and Freethought*, 251–252; Morus, *Frankenstein's Children*, 144.

Epilogue: Michael Faraday and a New Electrical Era

Michael Faraday has been celebrated as the greatest of all British practitioners of electrical science, whose portrait hung on Albert Einstein's wall as an inspiration, and whose brilliance made him the toast of Victorian literary and polite culture.¹ But despite the achievements of his career, Faraday cannot simply be read as a great Victorian man of science. He was born in 1791, and began his career as Davy's assistant at the Royal Institution in the 1810s, and his work was formed by and continued to be entrenched in the eighteenth-century discussions and cultures of electricity I have discussed in this book. Like many of his predecessors, Faraday's experimental practice and his religious faith pulled in different directions. He was a devout empiricist, who insisted on the importance of experimental methods, but also held that the ultimate cause of all phenomena of nature was divine.² And like so many eighteenth-century experimenters, Faraday found electricity an intriguing but immensely challenging object of study, a phenomenon which challenged the distinction between material and spiritual entities, and which perpetually exceeded the limitations of sensory evidence.

However, Faraday's experimental and theoretical practice also marks the close of the period I have examined. Though he remained a cautious and modest experimenter, alert to the limitations of his experience and understanding, the account of electricity that Faraday developed in the 1820s and 1830s ended the productive incoherence integral to accounts

of electricity up to that moment. Though it demonstrates important continuities with that of his predecessors, Faraday's work offered new proof that electricity should not be conceptualised as an obscure, highly communicative but material 'fluid', but rather as an abstract 'power' which might be subject to rules and even calculations. Faraday's theory of powers thus puts to an end the age of the 'imponderable' electric fluid and its multifarious figurative uses. As a result, metaphorical appropriations of electricity alter after the 1840s. As Laura Otis has shown, nineteenth-century writers continue to exploit images of electricity for various ends, but they draw connections between electricity, the nerves, and new technologies of communication such as the telegraph and the computer, rather than evoking a mysterious and vital fluid.³

Faraday made several crucial and related discoveries in electrical science in the 1820s and 1830s, which altered understandings of the relation between electricity and magnetism, and the nature of electricity itself. Even at this early stage in his career Faraday was an expert experimenter, but like Priestley and Davy before him, he approached the study of electrical phenomena by producing a historical survey of the work undertaken by his predecessors, declaring that 'after knowledge has been acquired, it is always desirable that it should be distributed'.⁴ Faraday's survey was published as an anonymous three-part 'Historical Sketch of Electromagnetism' in the *Annals of Philosophy* between September 1821 and February 1822. Despite describing his account as 'historical', Faraday was engaging with an entirely contemporary and fast-moving burst of research on the connections between electricity and magnetism, which had been stimulated by Hans Christian Ørsted's publication in 1820 of his findings that an electric battery 'if brought towards a magnetic needle . . . has the power of attracting and repelling it in a constant manner, and in obedience to certain simple laws'.⁵ Faraday pays warm tribute to Ørsted as the discoverer of electromagnetism, noting that he had raised the possibility of the mutual influence of electricity and magnetism as far back as 1807, and that 'his constancy in the pursuit of his subject, both by reasoning and experiment, was well rewarded . . . by the discovery of a fact of which not a single person beside himself had the slightest suspicion; but which, when once known, instantly drew the attention of all those who were at all able to appreciate its importance and value'.⁶ Ørsted produced an entirely new field of electrical research in the early 1820s, in which Faraday was to make his own intervention.

Ørsted's experiment was taken up and developed by researchers across Europe. In the 'Historical Sketch' Faraday focuses on the work of experimenters at the Académie des Sciences in Paris, in particular that of André-Marie Ampère, who, while he approved of Ørsted's findings, contested his theoretical conclusions on the nature of electricity. Ørsted suggested that the interaction between electric and magnetic forces meant that they could not be, as had always been assumed, distinct forms of superfine or imponderable fluids.⁷ Ampère, a strong proponent of fluid theory, rejected this conclusion and argued that magnetic phenomena were the result of the actions of the electric fluid.⁸ Faraday does not explicitly dispute Ampère's claim that 'magnetic phenomena are a series of electrical phenomena', but he does critique his methods to a degree that suggests his own scepticism about fluid models of electricity. Faraday notes, 'I am desirous . . . rather to mention the facts as they were discovered than the theories attached to them', and suggests that Ampère's fluid theory is 'premature, though convenient'.⁹ He goes further in the concluding part of the 'Historical Sketch', noting that Ampère has 'assumed the existence of two distinct electric fluids, and the identity of electricity with magnetism'. He continues, 'I think the first part of the theory by no means sufficiently developed. M. Oersted has, in this respect, aimed at more perfection than M. Ampere.'¹⁰ Ørsted has the upper hand for Faraday because he had proved his theory through experimental tests whereas Ampère had explained his empirical results through speculative theory.

As a strict empiricist, Faraday distrusts speculation like Ampère's in general, but he also hints at a specific scepticism about fluid models of electricity:

There are many arguments in favour of the materiality of electricity, and but few against it; but still it is only a supposition; and it will be as well to remember, while pursuing the subject of electro-magnetism, that we have no proof of the materiality of electricity . . .

Whatever be the cause which is active within the connecting-wire, whether it be the passage of matter through it, or the induction of a particular state of its parts, it produces certain very extraordinary effects.¹¹

For Faraday, neither Ampère nor any of his predecessors have produced experimental 'proof' that electrical, or electromagnetic, effects are caused by a material yet imponderable fluid. As a result, Faraday advocates caution, and indeed when he succeeded in producing the first electromagnetic rotation of a wire around a magnet in 1821, he refrained from offering a theoretical explanation of the phenomenon.¹² In the 'Historical Sketch',

however, he does hint that electromagnetic effects might be caused by the ‘induction of a particular state’ of the electric equipment. There was a long gap between Faraday’s early proof of electromagnetic rotation in 1821 and his next sustained work on electromagnetism, which he did not publish until 1831. He had been taken aback by Davy’s hostile response to his intervention in the discussion of electromagnetism, and found himself taken up by administrative and lecturing duties at the Royal Institution, Royal Military Academy at Woolwich and Royal Society.¹³ But when he returned to a sustained investigation of electromagnetism following Davy’s death in 1829, he revived his interest in electric ‘induction’, and strengthened his critique of fluid models of electricity.

Though Faraday, along with Ørsted and others, had shown in 1821 that magnetism could be produced by electricity, neither he nor his peers had been able to prove that electricity might also be produced by magnetism.¹⁴ In 1831 Faraday was determined to do so, and achieved his aim though a process of ‘induction’, producing an electric current by moving a magnet through a loop of wire.¹⁵ Faraday published his findings in the first of a series of *Experimental Researches in Electricity*, which he continued to produce until 1856. In the early 1830s Faraday also shifted his attention from magnetism to chemistry, and in 1832 showed through a series of electrochemical experiments that the apparently distinct forms of electricity, namely ‘Voltaic electricity, ordinary electricity, Magneto-electricity, Thermo-electricity, Animal electricity’, were in fact the same. As Faraday noted in the first of his *Experimental Researches* papers, the ‘general conclusion which must . . . be drawn from this collection of facts is, that *electricity whatever may be its source, is identical in its nature*’.¹⁶ In the third paper he goes further, noting that his findings also strengthen the scepticism about fluid models of electricity that he had expressed in his electromagnetic work. Electricity for Faraday ‘has never been resolved into simpler or elementary influences and may perhaps best be conceived of as *an axis of power having contrary forces, exactly equal in amount, in contrary directions*’.¹⁷ As Morus notes, Faraday’s conception of an electrical ‘axis of power’ was not greatly attended to by his contemporaries, who still generally ‘subscribed to the view that electricity was some kind of fluid’.¹⁸ But nonetheless, this fundamental challenge to the fluid model signalled a radical shift in understandings of electricity.

Faraday’s account of electricity has much in common with Davy’s work; indeed Davy’s scepticism about fluid models of electricity may first have suggested a doubt to Faraday, as Levere and Williams suggest.¹⁹ But Davy

is content to use electricity as an obscure but useful tool in the investigation of chemical affinity and animal electricity, a focus that remains clear in his final published paper in 1829, in which he uses Ørsted's breakthrough 'to ascertain if the electricity of living animals possessed [the] power' to affect magnetic needles.²⁰ Faraday moves beyond Davy's account of electricity as a useful but obscure tool, and asserts that electrochemical experiments might reveal the operations of electricity itself. He declares in the fifth of his *Experimental Researches* papers: 'The theory of... electro-chemical action appears to me to touch immediately upon the *absolute quantity* of electricity or electric power belonging to different bodies.' Like his predecessors, Faraday is frustrated but not disheartened by the limitations of empirical observation in this case: 'It is impossible, perhaps, to speak on this point without committing oneself beyond what present facts will sustain and yet it is equally impossible, and perhaps would be impolitic, not to reason upon the subject.'²¹ Through a detailed series of investigations, Faraday demonstrates that electricity is produced in the voltaic battery through a chemical reaction and not the contact of metals, as Volta had thought.²² And as James notes, when using Volta's pile Faraday found that 'electro-chemical action occurred not at the poles (as Davy had theorized) but in the solution itself', a discovery which strengthened his conception of electricity 'as an axis of power' rather than a fluid.²³ But Faraday was not ready to abandon fluid models of electricity altogether. In the fifth paper he states his uncertainty 'whether it consist of a fluid or fluids, or of vibrations of an ether, or another kind of condition of matter'.²⁴ Faraday's work suggested that electricity might be an abstract force, but he did not entirely discount long-held theories of electricity as a superfine material fluid.

Faraday emphasises the important continuities between his work and that which has gone before in the eleventh paper of his *Experimental Researches*. He declares of electricity:

Every part of it requires experimental investigation; not merely for the discovery of new effects, but... the development of the means by which the old effects are produced, and the consequent more accurate determination of the first principles of action of the most extraordinary and universal power in nature: – and to those philosophers who pursue the inquiry zealously yet cautiously, combining experiment with analogy... paying more respect to a fact than a theory [and]... willing at every step to cross-examine their own opinions, both by reasoning and experiment, no branch of knowledge can afford so fine and ready a field for discovery as this.²⁵

Here Faraday offers a condensed history of explorations of electricity over the course of the previous century. He notes the extent to which its ‘effects’ remain unexplained, even though it is ‘the most extraordinary and universal power in nature’. Researchers should attempt to explain these important effects, before being tempted to seek new ones. Faraday even sets out the experimental methods by which this might be achieved, implicitly critiquing the failings of those who have gone before. While the limited use of analogical reasoning is acceptable, Faraday notes, this must be combined with experiment, and any speculative urges held in check. But despite his ban on speculation, Faraday undoes his own rules, echoing the optimism of Priestley or Davy in his account of ‘the progress which electricity has made’ and might yet make: ‘Chemistry and Magnetism have successively acknowledged its over-ruling influence; and it is probable that every effect depending upon the powers of inorganic matter, and perhaps most of those related to vegetable and animal life, will ultimately be found subordinate to it.’²⁶ Faraday cites his own experimental proofs of the connection between electricity, magnetism and chemical affinity, but he cannot resist a gesture to the work of Darwin and Galvani and the more obscure operation of electricity’s vital properties, which had fascinated Davy till the end of his life.²⁷ Faraday’s eleventh *Experimental Researches* paper is the cornerstone of his groundbreaking account of electricity as a ‘power’, but he nonetheless situates it as a product of an eighteenth-century speculative tradition.

Faraday states that an ‘ever present question on my mind has been, whether electricity has an actual and independent existence as a fluid or fluids, or was a mere power of matter’, and sets out to solve this question in the eleventh paper.²⁸ In order to test his claims that electricity might be a power brought into action through induction, Faraday set up a spectacular experiment at the Royal Institution, in the form of a 12-foot paper cube, electrically charged on the outside. Faraday notes how he entered the cube and conducted experiments which showed that the inside was entirely unaffected by the exterior electrical charge.²⁹ This demonstrated to Faraday that ‘that non-conductors, as well as conductors, have never yet had an absolute and independent charge of one electricity communicated to them, and that to all appearance such a state of matter is impossible’, which strengthened his claims for electricity as a power rather than a superfine material fluid.³⁰ The cube experiment enabled Faraday to declare that electrical forces are produced by induction, ‘an action of contiguous particles consisting in a species of polarity . . . [not] an action

of either particles or masses at sensible distances'.³¹ Having observed this 'polarity' in action in the cube experiment, Faraday notes of induction, 'It is of the most general influence in electrical phenomena, appearing to be concerned in every one of them, and has... the character of a first, essential, and fundamental principle.'³² Faraday had stated that his theory of induction did 'not pretend to decide whether electricity be a fluid or fluids, or a mere power or condition of recognized matter'.³³ But the evidence of the cube experiment strengthened his claim that electricity was a 'power' affecting matter, not a distinct, superfine species of it.

Historians of science have tended to stress the iconoclastic implications of Faraday's findings, and with it his status as a man of genius. James notes how Faraday efficiently 'disposed of the notion that electricity was comprised of one or two fluids', and for Williams, he was 'almost alone among creative scientists [in believing] that the electrical powers were inextricably connected with matter... [and] could no more be separated from it than could chemical affinity or gravity'.³⁴ Such breakthroughs proved to 'be revolutionary and [to] feed back into the development of field theory. Electromagnetism, electrochemistry, and electrostatics were to be found merely to be different manifestations of one general and universal law.'³⁵ This in turn is understood to have enabled unprecedented industrial applications of electricity in lighting, transport and communication.³⁶ Faraday's findings did of course produce a change in conceptualisations of electricity. His emphasis on abstract powers over material fluids contributed to the falling away of the images of electrical contagion that proved so powerful in the previous century. But this process of change was a gradual one, and it is important to stress the continuities between Faraday's work and the earlier accounts of electricity that he is assumed to have 'disposed of'.

Faraday moves between the terms 'power' and 'force' when accounting for electricity and as David Gooding notes, his use of force is a generalising one, which even suggests the universalising tendencies of fluid models. 'Heat, light, magnetism, electricity, gravitation (weight), chemical affinity, cohesion, elasticity and inertia are all described by Faraday as forces.'³⁷ In contrast to successors like James Clerk Maxwell, he never attempts to quantify or systematise the operation of electrical force.³⁸ Faraday had no mathematical education; indeed, Morus suggests he 'thought that mathematics was a distraction from the real world of experiment'.³⁹ Despite the modernising effects of his breathtaking findings, Faraday was an empiricist in the eighteenth-century

tradition, having learned his electrical practice from Davy at a moment at which electrical phenomena remained a challenge and a mystery. The indeterminacy of Faraday's terminology aligns with his repeated insistence that experimenters should not be dogmatic, because there is so much that they have yet to determine.

Faraday also shares with many of his eighteenth-century predecessors a profound faith that God is the ultimate cause of action in the universe.⁴⁰ Such faith prevented him from enquiring too precisely into the operations of electrical forces, because it is 'impossible to know' God's ultimate use of such phenomena.⁴¹ As Cantor notes, Faraday insisted that 'the powers in the universe [and] how those powers are united to matter . . . are known to God alone'. The scientist's role is 'limited to discovering the effects of these powers and the laws by which they act and the relationship between them'.⁴² Faraday's sense of God's active role perhaps even influenced his conception of electrical powers as abstracted, or spiritualised. Gooding notes that for Faraday, "force" linked intellect with matter, underlying the intelligibility of the material creation'.⁴³ Despite his focus on experimentation, and his self-conscious emphasis on progress, Faraday's work displays important continuities with a much longer discussion of the nature of electricity. The theological implications of Faraday's abstract 'force' even suggest the immaterial 'active powers' or 'aether' of Newton or Berkeley, and Faraday himself seems aware of such continuities.⁴⁴

In the *Experimental Researches*, Faraday places himself within a long tradition of engagement with the 'most extraordinary and universal power in nature', and he continues to make such assertions throughout his long career. Looking back over his successes and failures in his 'Observations on Mental Education', a lecture delivered to the Royal Institution in 1854, Faraday asserts that a knowledge of electricity is the greatest challenge and greatest achievement of any experimenter. Faraday, like Adam Walker, insists on the need for humility, for alertness to the limits of human knowledge. His electrical researches have made this especially clear to him, because they demand an admission of ignorance, and openness to collaboration, which strengthens the mind,

for if it cannot distinguish proportionately between the probable right and wrong of things known imperfectly, it will tend either to be rash or hesitate . . . It is right that we should stand by and act on our principles; but not right to hold them in obstinate blindness, or retain them when proved to be erroneous. I remember a time when I believed a spark was

produced between voltaic metals as they approached to contact...but others doubted the fact and denied the proofs, and on re-examination I found reason to admit their corrections were well-founded.⁴⁵

Faraday had proved by experiment that the Voltaic battery produces electricity not through ‘contact’, as he first supposed, but through a chemical reaction. But rather than celebrate his empirical breakthrough, Faraday focuses on the admission of ignorance that prompted him to make the right experiment. Like Priestley, he suggests that collaboration and discussion are crucial tools for experimental success.

Electrical science is also important for Faraday because it reminds him of the need to move beyond the evidence of the senses in experimental practice. Though he rarely advocates any speculation beyond strict analogy, he notes here how the analysis of electricity requires a freer play of imaginative thought and figurative language. Faraday denies that research in the physical sciences should be ‘repressive of the imagination’. Rather,

the imagination should be taught to present the subject in all possible, and even impossible views; to search for analogies . . . to present the fundamental idea in every form . . . to clothe it with suppositions and probabilities, – that all cases may pass in review, and be touched . . . [by] experiment.⁴⁶

Imagination and figurative play are not meaningless ornaments or dangerous distractions, but aids to experiment. Faraday notes, however, that speculation must be kept ‘*under government*’, for the sake of ‘society’ who will act on the results of these experiments, but also for the sake of the experimenter who might be carried away by the ‘temptation they offer’. Strikingly, Faraday’s example of the fruitful use of figurative language evokes the model of electricity that his own experimental work has rendered obsolete. He declares:

We could not reason about electricity without thinking of it as a fluid, or a vibration, or some other existent state or form . . . still it is absolutely necessary that we should learn to doubt the conditions we assume, and acknowledge we are uncertain, whether heat and electricity are vibrations, or substances, or either.⁴⁷

Accounts of electricity as a fluid may have been proved false, but they functioned as a catalyst to research, by articulating and conceptualising its operations. Like Franklin and Kinnersley who note the limitations of the discourse

available to them, Faraday insists that researchers need to keep in mind the figurative nature of the language they employ, and not collapse together the figural and the literal. Such self-conscious use of analogy and metaphor ensures that the experimenter keeps in mind the limits of human knowledge.

Last, Faraday asserts that the physical sciences can make progress only through error, and it is the science of electricity that offers him the most apt support for his claim. The preceding hundred years might seem to have offered an unedifying succession of wild claims and crackpot theories, but, Faraday declares, they produced the experimental cultures of which he is a beneficiary.

Do not let us hear merely of the errors of scientific men . . . but let us see what, as a body, they have produced, compared with that supplied by their reproachers . . .

If we look to electricity, it, in the hands of a careful investigator, has advanced to the most extraordinary results: it approaches at the motion of his hand; bursts from the metal; descends from the atmosphere; surrounds the globe; it talks, it writes, it records, it appears to him (cautious as he has learned to become) as a universal spirit in nature.⁴⁸

Faraday offers a generous riposte to the ‘reproachers’ of electrical practice, listing the developments that have been made over the course of the last century, through which the functions of electricity can now be controlled and manipulated by skilled experimenters. But despite his claims for the dexterity of electrical practitioners, Faraday’s account pulls in two directions. Though he notes that the experimenter has learned to become ‘cautious’ of grand claims, this passage is vivified by enthusiasm at the ‘extraordinary’ effects of electricity, which in turn seem docile, violent, universal, and even sentient. Despite the caution he has ‘learned’, Faraday cannot resist concluding with a gesture to electricity’s sublime, even spiritual provenance as a ‘universal spirit in nature’. While Faraday’s work marked the end of an era in electrical speculation, his achievements were, to him, unthinkable without the insights, errors and play of his forebears.

NOTES

1. Thomas, *Michael Faraday*, 1; Thomas, ‘Faraday and Franklin’, 525.
2. See Cantor, *Michael Faraday*, on Faraday’s Sandemanian faith.
3. Electrical metaphors of vitality and communication have of course survived to the present day. See Ashcroft, *Spark of Life*.

4. Faraday, 'Historical Sketch', 195.
5. *Ibid.*, 197.
6. *Ibid.*, 195.
7. Christensen, *Hans Christian Ørsted*, 4.
8. *Ibid.*, 352. An important by-product of Ampère's adherence to fluid theories was his discovery of 'electrodynamism, the interaction between two parallel electrical circuits', *ibid.*, 379.
9. Faraday, 'Historical Sketch', 114, 274.
10. *Ibid.*, 117.
11. *Ibid.*, 196–197.
12. James, *Michael Faraday*, 38.
13. Thomas, *Michael Faraday*, 29–30.
14. Faraday, 'Historical Sketch', 281.
15. James, *Michael Faraday*, 57–58; Thomas, 'Faraday and Franklin', 533.
16. Faraday, *Experimental Researches*, 26.
17. *Ibid.*, 68.
18. Morus, *Michael Faraday*, 190.
19. Levere, *Affinity and Matter*, 44; Williams, *Michael Faraday*, 68–69.
20. Davy, 'Account of Some Experiments on the Torpedo', 16.
21. Faraday, *Experimental Researches*, 163.
22. *Ibid.*, 235–236, 259, 270, 314.
23. James, *Michael Faraday*, 63.
24. Faraday, *Experimental Researches*, 213.
25. Faraday, 'Experimental Researches. Eleventh Series', 1.
26. *Ibid.*
27. Faraday was fascinated by the function of nervous electricity. Otis, *Networking*, 23.
28. *Ibid.*, 3–4.
29. Thomas, 'Faraday and Franklin', 535.
30. *Ibid.*, 5. See also Williams, *Michael Faraday*, 290; James, *Michael Faraday*, 66.
31. Faraday, *Experimental Researches*, 3. See also *ibid.*, 6.
32. Faraday, 'Experimental Researches. Eleventh Series', 1–2. See also Williams, *Michael Faraday*, 291, 313.
33. Faraday, *Experimental Researches*, 37.
34. James, 'Introduction', xxvii; Williams, *Michael Faraday*, 288.
35. *Ibid.*, 269.
36. Thomas, *Michael Faraday*, 40, 43.
37. Gooding, 'Metaphysics versus Measurement', 11. See also Williams, *Michael Faraday*, 306.
38. James, *Michael Faraday*, 90.
39. Morus, *Michael Faraday*, 164.

40. Williams, *Michael Faraday*, 63.
41. Faraday, 'Lecture', 529.
42. Cantor, *Michael Faraday*, 185.
43. Gooding, 'Metaphysics versus Measurement', 3.
44. See also Fara, *Entertainment for Angels*, 122; Cantor, *Michael Faraday*, 178.
45. Faraday, 'Observations on Mental Education', 204.
46. [Ibid.](#), 207
47. [Ibid.](#), 207–208.
48. [Ibid.](#), 210.

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