Introduction

A Science Full of Shocks, Sparks and Smells

Bernadette Bensaude-Vincent and Christine Blondel

Enlightenment science was not something that could be confined to any narrow definition. Science, or natural philosophy as it was generally termed, could be practised for a variety of purposes in many different spaces, ranging from academies and learned societies to private cabinets and popular fairs, shops and boulevards. Scientific instruments were built and used not only for investigative and educational purposes but also for entertainment and popular shows. Air pumps, electrical machines, colliding ivory balls, coloured sparks, mechanical orreries, magic mirrors, speaking and defecating automata, and hot-air balloons constitute just a sample of the 'apparatus' used for public demonstrations. At the same time, public lecturers themselves mixed up social categories that were normally kept distinct, with aristocracy and clergy sitting side by side with merchants and university professors. Some of these public lecturers themselves succeeded in crossing national and social boundaries. Abbé Nollet, for instance, was a popular lecturer and writer who rose to become a professor and a member of the Paris Academy of Sciences.[1] As for the topics of public demonstrations, they ranged from mechanics, physics and chemistry, to anatomy. Everything – light, electricity, magnetism, water, gases, minerals, plants, cadavers and monsters – was apt to be displayed before the public. Between the culture of curiosities, which flourished in the seventeenth century, and the modern distinction between academic and popular science that emerged across the nineteenth century, Enlightenment science strikes us as a complex and multifaceted activity.[2]

Most of the clear-cut boundaries that serve to define today's science – divisions between academic institutions and the market place, between professionals and amateurs, between research and teaching, between work and leisure, between cognition and commerce – are irrelevant, precisely because many practices that were integral parts of science have subsequently been delegitimised and pushed

1 L. Pyenson and J.F. Gauvin (eds), *The Art of Teaching Physics: The Eighteenth-Century Demonstration Apparatus of Jean-Antoine Nollet* (Sillery, Québec: Septentrion, 2002).

2 W. Clark, J. Golinski and S. Schaffer (eds), *The Sciences in Enlightened Europe* (Chicago: University of Chicago Press, 1999); L. Stewart, *The Rise of Public Science* (Cambridge: Cambridge University Press, 1992). On the culture of curiosities see K. Pomian, *Collectionneurs*, *amateurs et curieux. Paris–Venise: XVIe–XVIIIe siècle* (Paris: Gallimard, 1987). On nineteenth-century popular science, see B. Bensaude-Vincent, and A. Rasmussen (eds), *La science populaire dans la presse et l'édition* (Paris: CNRS éditions, 1997).

to the margins of science. This volume – while itself full of sparks and smells – nevertheless raises broad issues about the ways modern science established its legitimacy and social acceptability through a process of 'purification' in which the 'scientific establishment' came, with ever greater authority, to condemn popular, entertaining and lucrative activities as non-scientific.

Our current notion of science may be a serious obstacle to understanding what was going on in cabinets, public courses and popular fairs. More generally, dealing with science in the early modern period requires making historiographic choices. The methodological precept – to forget about our present-day views of what science is or should be – applies in particular to eighteenth-century scientific activities. In order to capture their specificity, a pluralist notion such as 'scientific cultures' may be more appropriate than our modern monolithic and normative concept of science. We, as historians, need to resist the temptation of discriminating between 'real science' or its legitimate precursors and public spectacle. Thus, let us stroll about the streets of Paris with Michael Lynn and voyage through Germany with itinerant lecturers discovered by Oliver Hochadel. Let us have a look at the various demonstrations that disseminated science across multiple layers of society in the eighteenth century, thereby making an essential contribution to the construction of an 'enlightened public'.

Experiments in Shops, Streets and Cabinets

This volume arose from a conference held at the Cité des sciences et de l'industrie in Paris in 2003. The main purpose was to enlarge the scope of historical studies of eighteenth-century science so as to embrace the history of teaching institutions and the cultural history of consumption, especially that of entertainment and theatre.[3] With an almost exclusive focus on academic memoirs and publications, historians of science have been unable to see the wood for the trees. Alongside a few dozen illustrious academicians, there were hundreds of practitioners of science who made instruments, performed experiments, prepared medicines, and only occasionally published leaflets or a book. Exactly how many of these people were active in Europe in the eighteenth century? It is impossible to estimate their number, as something that most of them have in common is that they left little or no trace in the historical records that have come down to us.[4] Thus, one obvious reason for the traditional historical

3 See a similar enterprise for exploring the links between science, commerce and art in the seventeenth-century, P. Smith and P. Findlen (eds), *Merchants and Marvels: Commerce, Science and Art in Early Modern Europe* (New York: Routledge, 2002).

4 However, recent historical investigation of archival materials provide local rough estimations. John Perkins and Christine Lehman have already identified more than 40 chemical lecturers in eighteenth-century France (see B. Bensaude-Vincent and C. Lehman, 'Public lectures of Chemistry in eighteenth-century France', in L. Principe (ed.), *New narrative in Eighteenth-Century Chemistry* (Dordrecht: Springer, 2007) pp. 77–97; John Perkins, 'Chemistry courses, the Parisian chemical community and the chemical revolution, 1770–1790', presentation at the 6th International Conference on the History of Chemistry, Leuven, Belgium, 28 August –1 September 2007.

focus on academic science is the accessibility of sources. Nevertheless, public demonstrators have left some traces, particularly as some of them delivered courses in institutional contexts such as local academies, learned societies or botanical gardens. In such cases, institutional archives can help to reconstruct their activities, but most of them were isolated entrepreneurs who did not belong to any guild or institution and often travelled from country to country. In these cases, we may occasionally come across such a figure by digging into local archives or browsing contemporary newspapers, but we are left to speculate as to what proportion such finds represent. Despite these practical difficulties, over the past decades scholars have brought to light an impressive number of picturesque but hitherto unknown figures, such as the Englishmen Stephen Demaimbray and Benjamin Martin, the Italians Laura Bassi and Giacomo Bianchi, or the Frenchman François Bienvenu, who are gradually becoming visible in the historical landscape.[5] These men and women travelled all over Europe, regularly crossing national boundaries, and occasionally adapting their names to fit the local language. Together with the essays published in the present volume, studies of such figures provide insights that can begin to limn the contours of a culture of scientific shows or performances that represents an essential element of a more adequate and complete image of eighteenth-century science.[6]

The roots of this scientific performance movement lie partly in teaching institutions, which gradually added experimental physics to the course of philosophy inherited from the scholastic curricula. As Laurence Brockliss has pointed out, a number of colleges in France developed experimental courses independent from philosophy teaching and most often open to the public.[7] Professors in European universities, such as s'Gravesande in Leyden, John Theophilus Desaguliers in London, Georg Christoph Lichtenberg in Göttingen, Alessandro Volta in Pavia and other, less well-known teachers in Dublin or Coimbra, gave public lectures in experimental physics. Public courses in chemistry and botany also attracted large audiences, made up of medical and pharmaceutical students as well as *philosophes* and *curieux*. Thus, teaching institutions became places for exchange between establishment and amateur scientists, as well as laymen and women.

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5 On Demaimbray: A.Q. Morton and J.A. Wess, *Public and Private Science: The King George III Collection* (Oxford: Oxford University Press, 1993); on Bassi: P. Findlen, 'Science as a career in Enlightenment Italy: The strategies of Laura Bassi', *Isis*, 84 (1993): 441–69; on G. Bianchi: O. Hochadel, 'A Shock to the Public: Itinerant Lecturers and Instrument Makers as Practitioners of Electricity in the German Enlightenment (1740–1800)', in F. Bevilacqua and L. Fregonese (eds), *Nuova Voltiana. Studies on Volta and His Time*, vol. 5 (Pavia: Hoepli, 2003), pp. 53–68; on Bienvenu: P. Bret, 'Un bateleur de la science : Le «machiniste-physicien» François Bienvenu et la diffusion de Franklin et Lavoisier', *Annales historiques de la Révolution française*, 339 (octobre–décembre 2004): 95–127.

6 See the special issue on 'Science Lecturing in the Eighteenth Century', A. Morton (ed.), *British Journal for the History of Science*, 28 (1995), Part I.

7 Laurence Brockliss, 'Science, the Universities and Other Public Spaces: Teaching Science in Europe and the Americas', in R. Porter (ed.), *Eighteenth-Century Science*, *The Cambridge History of Science*, vol. 4, (Cambridge: Cambridge University Press, 2003), pp. 44–86.

Instrument makers were another major driving force in the emergence of experimental shows. Public demonstrations stimulated the design and manufacture of scientific instruments, covering not only classic instruments constructed for demonstrations of established phenomena but also instruments for scientific inquiry, as well as instruments for technical uses such as navigation. Indeed, many public lecturers were multifaceted, with Bianchi, Benjamin Martin and Sigaud de la Fond fulfilling the functions of builders, demonstrators, sellers, travellers, writers and participants in controversies.[8] These *hommes-orchestre* operated across social categories, playing a key role in the promotion of experimental science, contributing to its visibility in the public sphere.

Shops and workshops thus became favoured spaces for the display of machines and instruments. Here, customer-visitors could see science in action, discuss and compare the performances of instruments and order apparatus to equip their own personal laboratories. In England, shops were also meeting places where a form of reciprocal instruction became possible. The chapters by Larry Stewart and Liliane Pérez outline the role of merchants who cultivated profit and beauty and the emergence of a category of 'philosophical consumers' who moved from public to private spaces and developed a kind of tourism combining entertainment and learning.

Between Entertainment and Utility

As public demonstrations were often advertised as practical, sensational or even dramatic, this volume outlines two major features of the culture of science in the eighteenth century: entertainment and utility. Entertainment was a primary concern, but it does not mean that scientific demonstrations were not serious activities. Most essays in this volume show instead that entertainment went hand in hand with pedagogical purposes, as a number of lecturers claimed to offer access to knowledge by way of amusement. Experimental physics, for instance, initiated the tradition of science for fun. Jessica Riskin emphasizes the intermingling of tricks and true demonstrations. Amusing physicists played magicians while instructing their audience in natural philosophy. Chemistry lectures were apparently more didactic. In most cases they offered the only opportunity for medical students, apothecaries, miners and craftsmen to learn about chemical preparations. The chapter by Lehman on chemical lectures in Paris suggests that instruction was a prominent force behind the creation of public chemical demonstrations that, whether public or private, provided basic laboratory training for vocational purposes. They were also attended by artisans and women who needed to learn some chemistry for practical or domestic work.[9] However, Jan Golinski's presentation of Joseph Priestley's lectures and Lissa

8 On B. Martin: J.R. Millburn, 'The London evening courses of Benjamin Martin and James Ferguson: 18th-century lectures on experimental philosophy', *Annals of Science*, 40 (1983), 437–55 ; S. Schaffer, 'The consuming flame: Electrical showmen and Tory mystics in the world of goods', in J. Brewer and R. Porter (eds), *Consumption and the world of goods* (London: Routledge, 1993), pp. 489–526.

9 In the eighteenth century, women were often in charge of the fabrication of cosmetics, medicines and cleaning products. See C. Lanoe, 'Les jeux de l'artificiel. Culture, production

Roberts's presentation of Guillaume-François Rouelle's lectures show that, beyond all educational aspects, chemical lectures were also theatrical performances meant to impress the audience.

The crowds of people who attended public demonstrations and exhibitions were not all motivated by vocational interests. A number of essays in this volume emphasize the importance of commercial concerns associated with public demonstrations. Beyond merchants' displays in shops and workshops, public demonstrations served as a source of profit for instrument makers or pharmacists, who used to sell the products of their skills at the end of the lectures, wares often associated with a popular book or manual. As Larry Stewart and Liliane Pérez emphasize, public demonstrations fitted well with the burgeoning market ideology, triggering fierce competition between artisans and inventors, and helping to finance inventions, thanks to entrance fees or subscriptions paid in advance.

The best-paying customers were often members of the aristocracy who were searching for material to equip their private cabinets.[10] There were also many aristocratic amateur scientific practitioners in *ancien régime* France,[11] including Voltaire and Émilie du Chatelet, who acquired a large collection of physics instruments from the Abbé Nollet for 10,000 *livres*. Provincial academies, learned societies, amateur circles, and clubs provided many opportunities to perform experiments in front of either large or limited audiences, and thus to disseminate science and technologies.[12] Although we have no reliable evidence concerning scientific discussions that took place in Europe's salons, it is unlikely that amateur scientists refrained from discussing their experimental ventures in their evening conversations.[13] Experimental demonstrations even gained the favour of royal courts, with King George III of England owning a magnificent collection of scientific instruments. In France, Louis XV provided Abbé Nollet with an official appointment and ordered the performance of public experiments in the Hall of Mirrors at Versailles. Likewise, when Emperor Joseph II of Austria visited Paris in the 1780s, he invited his guests to attend the public demonstrations performed by Nicolas-Philippe Ledru.

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et consommation des cosmétiques à Paris sous l'Ancien Régime XVIe–XVIIIe siècle' (PhD dissertation, University of Paris I, 2003).

10 J. Torlais, 'La physique expérimentale', in R. Taton (ed.), *Enseignement et diffusion des sciences au XVIIIe siècle* (Paris: Hermann, 1986), pp. 619–45.

11 The tax collector Dupin de Francueil had a private cabinet in Chenonceaux. In 1743, he appointed Jean-Jacques Rousseau to teach his son. See B. Bensaude-Vincent and B. Bernardi (eds), *Rousseau et les sciences* (Paris : L'Harmattan, 2003).

12 Simon Schaffer, 'Natural Philosophy and Public Spectacle in the 18th Century', *History of Science*, 21 (1983), 1–43; Michael R. Lynn, 'Enlightenment in the Public Sphere: The Musée de Monsieur and Scientific Culture in Late-Eighteenth-Century Paris', *Eighteenth-Century Studies*, 32 (1999), 463–76.

13 Antoine Lilti, *Le monde des salons. Sociabilité et mondanité à Paris au XVIIIe siècle*, Paris: Fayard, 2005.

The Epistemic Power of Sensationalism

The essays in the present volume suggest that public demonstrations not only served to disseminate science into society, but also contributed in various ways to the advancement of knowledge. Of course, the primary aim of such demonstrations was to attract as large an audience as possible; as Abbé Nollet confided to Benjamin Franklin:

> I am far from blaming those who, not sharing my views […] are busy making brilliant or even terrifying experiments, and sustaining the admiration of the *curieux* who take part in these discoveries [...]; electricity becomes more interesting as the number of amateurs increases.[14]

Public demonstrations encouraged experimental practices outside the limits of academic institutions. Instrument makers became key actors on the scientific stage and some of them enjoyed academic recognition. In support of this claim, we can cite Abbé Nollet in France, George Adams in England and Amici in Italy, all of whom were raised to academic status following a career as public lecturers.

Public demonstrations helped legitimize experimental knowledge. As Louis-Sébastien Mercier, a keen observer of Paris culture, noted at the end of the eighteenth century: 'The reign of humanities is over, physicists replace poets and novelists, the electrical machine takes the place of a theatre play.'[15] The long-standing negative image of laboratory experimenters as manual workers, sweating over their long and physically demanding labour, was gradually being replaced by an alternative rhetoric that attacked scholars pontificating in their doctoral robes and praised laboratory work.

Advocates of experimental practices flourished in the 1750s, especially in the circle of the *philosophes*. Here, it is sufficient to cite Diderot's assault on the speculative and abstract knowledge of those who were only able to 'reflect', but who 'have many ideas and no instruments', in his *De l'interprétation de la nature*. In the same year, 1753, Gabriel François Venel's heroic portrayal of the chemist as an 'artist' in the article 'chymie' of the *Encyclopédie*, echoed Diderot's defence of experiment.[16] Venel saved his praise for the true chemist, who was ready to take off his gown and base his knowledge on practical work. Since experiments required much money and courage, experimenters were 'citizens who deserve all our thanks'. The traditional clichés about the power of experimental evidence and the no-less-

14 'Je suis bien éloigné de blâmer ceux qui, ne pensant pas comme moi, […] s'occupent à rendre les expériences brillantes ou même effrayantes, et à soutenir l'admiration des curieux qui prennent part à ces découvertes [...]; l'électricité devient par là plus intéressante, le nombre des amateurs augmente.' Nollet, Jean-Antoine, *Lettres sur l'électricité*, Paris, 1753, p. 29.

15 L.S. Mercier, 'Le règne des lettres est passé, les physiciens remplacent les poètes et les romanciers, la machine électrique tient lieu d'une pièce de théâtre', in Jeremy D. Popkin (ed.), *Panorama of Paris*, , (University Park: Penn State University Press, 1999).

16 Simon Julia, *Mass Enlightenment: Critical Studies in Rousseau and Diderot* (Albany: State University of New York Press, 1995).

common attacks on the 'esprit de système' were rooted in the robust soil of the daily demonstrations that introduced laymen to the secrets of natural philosophy.

Jessica Riskin argues that visual experience was considered a major source of knowledge and that the advancement of knowledge presupposed empirical training. Despite his oppostion to Nollet's Cartesianism, Voltaire confessed that 'one learns more from Abbé Nollet's experiments than from all the books of Antiquity.'[17] The power of visual experience was legitimized by the prevailing empiricist philosophy, which claimed that all ideas originated in sensation. If knowledge entered the mind through the senses, then public demonstrations were the best form of pedagogy. Watching the experimental performance was a way to re-enact the generation of ideas on the *tabula rasa* of the child's mind that is at the origin of our ideas. And the demonstrator's commentary or the book sold at the end of the show helped to build up more complex notions. Vision was the most important sense in the Enlightenment period. What kind of knowledge could be acquired by blind people was a standard philosophical issue discussed in works ranging from Locke's *Essay on Human Understanding* (1690) to Diderot's *Lettre sur les aveugles* (1749). For most philosophers, visual experience was not only the origin of ideas but also the key to all intellectual processes.

While sensation was the necessary basis of all knowledge, sensibility also formed part of the epistemic strategies of the Enlightenment.[18] Admiration and repulsion, the sense of the sublime and the sense of horror, all such aesthetic emotions aroused by tragedy were occasionally mobilized by public demonstrators. With the coming of pneumatic chemistry, Jan Golinski argues, chemical lectures developed an aesthetic sensibility to the terror of the forces of nature that confined the culture of 'sublime', in fine arts and literature. Aesthetic sensibility was also part of the exhibitions of anatomical specimens. As Jonathan Simon's chapter on Honoré Fragonard convincingly argues, the anatomical specimens made for teaching purposes were also meant to impress the public. Affects and emotions were not banished from science learning.

Theatres of Nature

With the use of theatrical performances to display natural phenomena, science was participating in eighteenth-century aesthetics. As Lissa Roberts's contribution emphasizes, theatrical settings, with the audience sitting around a stage upon which experiments were performed or models exhibited, were supposed to display nature itself. It was of no consequence that the stage was covered with artefacts such as vessels, instruments or wax models. This apparatus simply helped to unveil nature, to magnify its aspects or emphasize its processes. Furthermore, such theatrical

17 Xenophanes 'on apprend plus dans les seules expériences de l'abbé Nollet que dans tous les livres de l'antiquité' (www.voltaire-integral.com/20/xenophanes.htm).

18 Riskin has convincingly argued that the French *philosophes* encouraged the use of the emotions for understanding nature, rather than excluding them as epistemological obstacles J. Riskin, *Science in the Age of Sensibility. The Sentimental Empiricists of the French Enlightenment* (Chicago, London: Chicago University Press, 2002).

demonstrations can be understood as indirect descendants of the theatre metaphor used to depict natural philosophy, although its meaning shifted dramatically across the eighteenth century. For Louis Bernard Bovier de Fontenelle, who is often considered the founding father of science communication, nature was a spectacle performed on a theatre stage.[19] Fontenelle ridiculed the naive audience sitting in the stalls, uncritically satisfied with the visual experience provided by the performance, and praised the natural philosopher, whose place was behind the stage, trying to grasp the mechanisms at work. Far from undermining the beauty of nature, going beyond the appearances in order to understand the hidden causes was interpreted as a way of augmenting the dignity of nature. By contrast, in the mid-eighteenth century, the best-seller *Le spectacle de la nature* written by Abbé Noel-Antoine Pluche developed the same metaphor, but this time clearly favouring the visual experience of the audience in the stalls. He did not care that 'the mechanisms of the machines be opened' as his object was to retain 'what is visually striking'.[20] Pluche and other public lecturers who reasoned in the same way were not, however, encouraging a passive and lazy attitude on the part of the audience. Rather, they wanted the focus to be placed on what could be made apparent, that is, on the 'phenomena' in the etymological meaning of the term, because the spectacle was aimed at stabilizing phenomena rather than penetrating to their hidden causes. Far from confining the audience to the passive contemplation of nature's wonders, public demonstrations encouraged the construction of devices and instruments, and the replication of experiments. In this respect they not only stimulated the practices of science in various social contexts but also contributed to the stabilization of phenomena and advancement of knowledge. Hundreds of replications of the same experiments generating sparks or explosions transformed occasional events into regular phenomena, thus reinforcing the conviction that artificial devices could reveal nature itself. Moreover, these phenomena were observed and commented on by hundreds of spectators, making them integral parts of culture and prompting fierce debates touching on philosophical and religious issues. For clergymen such as Nollet, Priestley or Haüy, public demonstrations were also a way of displaying God's magnificence. From this perspective, the natural philosophers could accompany their exhibitions of the wonders and marvels of light, electricity and the vacuum with disquisitions on their theological and moral implications serving to edify their audience. Thus, they acted as mediators, acting out the role of ministers celebrating religious services in a different context.

Enlightening the Public

Following the pioneering work of Jürgen Habermas on the emergence of the public sphere, the tremendous impact that the emerging public sphere had on the political

19 L.B. Bovier de Fontenelle, *Entretiens sur la pluralité des mondes habités*, 1686 (republished Paris: Fayard, 1991).

20 N.A. Pluche, *Le spectacle de la nature ou entretiens sur les particularités de l'histoire naturelle* (Paris, chez la veuve Estienne), vol. 1, 1749, p. x.

life of a number of European countries has been well documented.[21] It is equally well established that the public played a significant part in the emergence of modern experimental science, as has been shown in a number of exemplary case studies.[22] Nevertheless, the public considered in such studies is mostly restricted to the upper classes. By contrast, a number of essays in the current volume testify to the fact that the public interested in science and technology covered a far wider social spectrum. People from the lower classes were also provided with food for thought by public performers, and were no less qualified than the social elite to appreciate the wonders of nature and deconstruct experimental tricks. Furthermore, the heterogeneity of the audience for science had a significant impact on its authority in society, with the witnessing of sparks, light and smoke by ladies, clergymen, artisans, doctors and *philosophes* helping to make such evidence more compelling. These 'epistemological dramas' also contributed to the promotion of science and reason above the traditional authority of religion in modern societies, with Cartesians and Newtonians using these phenomena as a means to spread their respective gospels through popular publications, public lectures and public demonstrations. The heterogeneous audiences for scientific demonstrations were crucial for making the bridge between scientific culture and common sense. They thus helped make non-intuitive scientific propositions – such as inertia or the movement of the earth – more real than the convictions generated by untutored daily observation.

The crowds that attended the public lectures delivered all over Europe also generated the famous 'public taste for science (*goût public des sciences*)' that was recognized as a major feature of the period by many contemporary commentators such as Mercier, or the chemist Pierre-Joseph Macquer. As scientific spectacles became integral parts of urban social culture, public lecturers spread their ideology, world-views and values through material phenomena. Robert Darnton has argued that the crowds that gathered to look at hot-air balloons or to participate in the adventures of Mesmer's magnetic tub helped to discredit the order of the *ancien régime* and contributed to the origins of the French revolution.[23] Without venturing into causal explanations of historical events, one can reasonably conclude that the multiple cultures of sciences favoured rational world-views that competed with religious belief and traditional notions of political order. Scientific spectacles created

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21 J. Habermas, *The Structural Transformation of the Public Sphere*, trans. Thomas Burger (Cambridge: MIT Press, 1989). See also Arlette Farge, *Dire ou mal dire. L'opinion publique au XVIIIe siècle* (Paris: Seuil, 1992), English transl., *Subversive Words. Public Opinion in Eighteenth-Century France* (Philadelphia: Penn State Press, 1995).

22 S. Shapin and S. Schaffer, *Leviathan and the Air-pump. Hobbes*, *Boyle and the Experimental Life* (Princeton: Princeton University Press, 1985); E. Eisenstein, *The Printing Revolution in Early Modern Europe* (Oxford: Oxford University Press, 1993).

23 R. Darnton, *Mesmerism & the End of the Enlightenment in France* (Harvard University Press: Cambridge, Mass., l968); C.C. Gillispie, *The Montgolfier Brothers and the Invention of Aviation*, *1783–1784* (Princeton: 1983). Recent historical studies include J.M. Hunn, 'The Balloon Craze in France, 1783–1799: A Study in Popular Science', (unpublished PhD dissertation: Vanderbilt University, 1982); M. Thebaud-Sorger, '"L'air du Temps". L'aérostation: savoirs et pratiques à la fin du XVIIIe siècle (1783–1785)' (unpublished PhD thesis, Paris, École des hautes études en sciences sociales, 2004).

a niche for public debate – along with cafés and newspapers – located in between the official sphere of national or provincial academies and the private sphere of the family and the salons.

Thus, science gained sufficient credit in the public sphere that it was considered perfectly legitimate for governments to finance and organize scientific research in the early nineteenth century and to introduce science teaching in education systems. But before science and scientists retired into their academic ivory towers and a new generation of teachers took on the task of transmitting science to students, there was a time – in the early nineteenth century – when scientific reputations were enhanced by a capacity to present science in public performances. Many scientists, such as Humphry Davy or Michael Faraday at the Royal Institution in London, maintained for some time the tradition of spectacular demonstrations.[24]

By means of their dazzling performances, public lecturers thus managed to engage various fractions of civil society in science. In this respect their experimental culture – between the age of curiosity and the age of popular science – constitutes a genre of its own that could be labelled 'civil science'

We are grateful to Jonathan Simon for the translations and rewritings into the English language. We also thank the Centre de recherche en histoire des sciences et des techniques (CNRS-Cité des sciences et de l'industrie) for the organisation of the workshop which initiated this volume.

24 David M. Knight, 'Getting Science Across', *British Journal for the History of Science*, 29 (1996), 129–38; 'Scientists and their publics: Popularisation of science in the nineteenth century', in Mary-Jo Nye (ed.), *The Cambridge History of Science*, *volume 5*, *The Modern Physical and Mathematical Sciences* (Cambridge: Cambridge University Press, 2003), pp. 72–90.