EGO European History Online

The Popularisation of Science

by Peter Bowler

In recent decades historians and sociologists of science have significantly revised their views on how science relates to popular culture. They have replaced the model in which scientific knowledge is disseminated to a passive audience with one in which there is constant two-way interaction between the scientific community and the public. For much of the time since the emergence of modern science in the seventeenth century those who investigated nature operated in an environment where relating their work to patrons and supporters influenced how that work was done. The image of a professional scientific community remaining aloof from the public and relying on science writers and journalists to disseminate a simplified report of their research findings could not be applied to these early periods and was never truly valid even for the late twentieth century. This article outlines the new interpretation of the relationship between science and the public and surveys changes in how the interaction worked from the seventeenth century to the present. Initially there was no professionalized scientific community and those who studied nature had to arouse the interest of aristocratic patrons and eventually larger groups who could provide financial support. In the mid-nineteenth century it was still taken for granted that scientists were public intellectuals who engaged in debates about the wider implications of their work. Major theoretical initiatives were launched in books that could be read by the educated layperson. Even when a professionalized scientific community emerged at the end of the nineteenth century, a significant proportion of scientists still saw it as their duty to encourage support for their work by writing educational material for non-specialist readers. Although many abandoned this responsibility temporarily in the later twentieth century, recent developments have again shown the scientific community that it is necessary to engage with public concerns about the impact of applied science.

TABLE OF CONTENTS

1. Science Studies and the Problem of Popularisation
2. The 17th Century: Science and Patronage
3. The 18th Century: Science and Enlightenment
4. The 19th Century: Modernisation vs. Tradition
5. The 20th Century: Technology and the Ivory Tower
6. Appendix
    1. Sources
    2. Literature
    3. Notes

Indices
Citation

Science Studies and the Problem of Popularisation

In recent decades, the question of how science (➔ Media Link #ab) is related to the general public has aroused much concern in the scientific community. In the middle decades of the 20th century, professional scientists often preferred to focus on their research, leaving the popularisation of their results to science writers. These would produce simplified accounts of discoveries that could be absorbed by a general public which, it was assumed, was keen to learn about the latest developments. This top-down model of dissemination to a passive public has been called the "dominant model" of science popularisation. Its weaknesses were soon made apparent by the emergence of public concerns about the applications of science in areas such as the nuclear industry and a growing awareness of man-made threats to the environment. The public was not passive, nor was it convinced that scientific advances were always beneficial, and professional science writers increasingly responded to these concerns. Scientists too have learned that they must engage actively with the public if they are to keep their research going, and an increasing number of them are willing to participate in this engagement.[1]

▲1

Historians of science have pointed out that this "dominant model" does not apply to the periods before a professionalised scientific community emerged in the late 19th century. Indeed, it can be shown that even in the early 20th century, many scientists still played an active role in spreading their ideas to the public, often seeking to promote particular interpretations of their results. If there ever was a period when the scientific community retreated into its ivory tower and left popularisation to others, it was a brief episode created by a

particular set of circumstances arising in the middle of the 20th century. Even then, this situation was characteristic mainly of the English-speaking world – comparative histories reveal that the nature of science popularisation depends very much on local cultural norms and differs considerably from country to country.

▲2

This article will survey developments in the relationship between science and the public from the 17th century, when something resembling modern science first emerged, to the present. As the scientific community expanded, it gained greater autonomy, but throughout the 18th and 19th centuries, this independence was never secure enough to encourage a tendency to retreat into an "ivory tower". It was always necessary to engage with the educated public to ensure support for science itself, or for a particular theoretical or practical development.

▲3

In its early form, the scientific community depended on the patronage of noble or royal families and needed to present its results to those patrons in a manner they would find attractive. The situation gradually changed as science became more important as a source of technical expertise to industry (➔ Media Link #ac) and governments. The results now had to be distributed more widely, though the interests of the patrons still had to be taken seriously. Despite the major expansion of the scientific community and its increasing professionalisation in the 19th century, the growth of mass publishing created an ever-widening arena for public debate over the implications of science, and many scientists recognised the need to engage in these debates. In countries where professional science did not expand so rapidly, there were debates of a different kind about the role science might play in modernisation (➔ Media Link #ad). Only in the particular circumstances prevailing in America and Britain after World War II did there emerge, however briefly, reluctance among scientists to play a role in how their field was related to the public.

▲4

The 17th Century: Science and Patronage

In the 17th century, there were few academic positions dedicated to research in natural philosophy. Galileo Galilei (1564–1642) (➔ Media Link #ae) and Isaac Newton (1642–1727) (➔ Media Link #af) both occupied chairs in mathematics at some point in their careers, but such opportunities were few and far between. The other source of support was the patronage of royalty, the aristocracy, or senior figures in the Church. Galileo became court philosopher and mathematician to Cosimo II of Tuscany (1590–1621) (➔ Media Link #ag), while Johannes Kepler (1571–1630) (➔ Media Link #ah) was astronomer to the Hapsburg emperors. Both sought to glorify the name of their patrons by linking their names to their discoveries.

▲5

At the same time, Galileo took an important step by publishing his later works, including his controversial *Dialogo sopra i due massimi sistemi del mondo* of 1632 (*Dialogue on the Two Chief World Systems*, translated in 1661), in the vernacular rather than Latin.[2] The books were thus available to all those who were literate (➔ Media Link #ai), but they did not have to be members of the clergy or learned professions. As trade and commerce became more important sources of wealth, even aristocratic patrons could appreciate the publicity value of reaching out to a wider social circle. Although Newton still published in Latin, by the end of the century it was becoming commonplace to publish in the vernacular, and a Europe-wide system of translation (➔ Media Link #aj) emerged to disseminate texts more widely.[3]

▲6

Artisans and tradespeople also had very practical interests in technical matters and encouraged the link between the new learning and industrial innovation. At this point, divisions became apparent between those countries in which royalty and the aristocracy remained dominant and those where a rising middle-class deriving its income from trade and industry began to gain political power. The latter phenomenon was perhaps most striking in Britain, but also prevailed in the Netherlands, Scandinavia and some of the German states. The kind of literature on science that was published reflected the interests of the consumers, and thus we begin to see differences in the content and style of writing of books in countries. In France, for instance, books were still aimed at a courtly audience, whereas in Britain there was a focus not just on technical matters, but also on the use of Newtonian science to buttress the ideology of the new aspiring middle classes. Natural theologians such as William Derham (1657–1735) (➔ Media Link #al) presented the world as a harmonious system designed by God, with checks and balances built in, similar to the British constitution, which guaranteed entrepreneurs the freedom to innovate.

▲7

These differences can be observed in the first societies founded to promote what we now call science. The Paris Academy of Sciences, founded in 1666 by the French state, was supported from tax revenues in the hope that it would provide valuable information to government-sponsored enterprises. The Royal Society of London, by contrast, received only token support from the King. It brought together a collection of enthusiastic gentlemen (sometimes called the virtuosi) and men with more practical interests. The Society claimed to follow the philosophy of Francis Bacon (1561–1626) (➔ Media Link #am), which avoided theoretical speculation in favour of gathering facts, although (as Newton confirmed when he became president of the society) the two activities could not so easily be separated. At the social level, tension emerged between those who thought their status as gentlemen gave them a privileged position when judging the veracity of natural knowledge and those who were most interested in practical utility. Both sides agreed, however, on the need to spread knowledge, and the coffee-houses of London formed a perfect location in which discussion of the latest developments could take place.

▲8

The 18th Century: Science and Enlightenment

The 18th century saw a continuation of trends established in the closing decades of the previous century. Science, and technical knowledge more generally, were increasingly perceived as crucial features of the new "Age of Enlightenment (➔ Media Link #ao)". As trade and industry expanded, innovation became increasingly prized, and the line between abstract natural philosophy and technical expertise became blurred. The audience for information about the latest developments increased as more people became literate and had some spare time and money which they might devote to science. However, the expansion of the middle classes created tensions as those who participated in trade became impatient with the remnants of aristocratic authority. The presentation and discussion of science thus became one among many battlegrounds in which ideologies struggled to gain or retain authority. We know more about the situation in Britain during this period than we know about other countries, perhaps because the country's leading role in the Industrial Revolution has focused historians' attention onto social developments associated with the rise of technical knowledge.[4] The differences between the situation in the newly industrialising states and those that retained a monarchical and agrarian system became more visible.[5]

▲9

Newtonianism was a key theme in the popularisation of science, but it meant different things to different audiences. In France, Newton's worldview and methodology were promoted as a vehicle for social reform, but the system remained wedded to monarchical centralisation until the revolution of 1789. The great *Encyclopédie* edited by Denis Diderot (1713–1784) (➔ Media Link #aq) and Jean Le Rond d'Alembert (1717–1783) (➔ Media Link #ar) in 1751 was a reaction to the need for better knowledge of science and industry, but it was nevertheless aimed at the social elite rather than those who actually participated in trade.[6] Aristocratic salons discussed the implications of new scientific discoveries, and witnessed demonstrations of the effects produced by electricity and other natural forces.

▲10

In Britain, too, lectures and displays were just as important as print to acquaint the public with new scientific and technical developments. Lecturers such as John Theophilus Desaguliers (1683–1744) (➔ Media Link #as) toured the country to explain the new knowledge and demonstrate its practical applications. The boundaries between those who engaged in this form of dissemination and those who actually created new knowledge were fluid, however, and to some extent the ability to perform in front of the public became an essential element in the acquisition of the status as an expert. Desaguliers and other high-profile figures promoted a popular Newtonianism, but it had to be adapted to the social values of the audience, which in the early decades of the 18th century was still dominated by a social elite that recognised the value of trade but had no wish to promote social upheaval. So Newton's philosophy was often presented as the appropriate foundation for a worldview in which God was seen as the architect of a rationally-ordered creation. Knowledge of this creation would be of benefit to the human race, provided underlying moral values were preserved.

▲11

As the century progressed, however, more radical voices began to be heard and there were increasing calls for the distribution of knowledge to a wider public. Outside London, there were organisations such as the informal Lunar Society (➔ Media Link #at) which encouraged links between industrialists such as James Watt (1736–1819) (➔ Media Link #au) and those who promoted the new sciences. Erasmus Darwin (1731–1802) (➔ Media Link #av), for instance, was a medical doctor who advanced new ideas about the nature of life, including a theory of evolution, and promulgated them in lengthy poems that were widely popular at the time. Darwin was also read in polite society, but he was perceived as a dangerous radical in conservative circles.[7] At this time it was still radical to believe, such as the chemist Joseph Priestley (1733–1804) (➔ Media Link #aw) did, that the new science should be open to all, and all should have an education sufficient to allow them to make judgments about it. It was easy to stir up popular antagonism with such

ideas, especially after Britain had emerged as a leading opponent of the revolutionary regime in France. In fact, Priestley's house in Birmingham was burned by the mob in 1791 and he eventually moved to America. But the attempt to disseminate knowledge more widely continued, and institutions such as the Mechanics Institutes were created to provide educational opportunities for working men. Reading material on science and technology featured strongly in the libraries held by these and similar institutes.

▲12

The 19th Century: Modernisation vs. Tradition

As the industrialisation of Britain and other northern European countries continued, the proportion of the population able to read expanded, creating an ever-wider and more socially diverse audience for literature on science and other areas of knowledge. At the same time, new printing technologies enabled books and periodicals to be produced more cheaply, pointing the way to the mass consumption of print (➔ Media Link #ax) that would become universal by the end of the century. There were also significant changes in the way science was organised and in its relationship to society at large. In Germany and later in other countries, universities began to treat natural science as a normal component of the curriculum and to found departments with research laboratories (➔ Media Link #ay). Governments and industrial concerns began to fund scientific and technical research. By the last half of the century, something like the modern scientific community began to emerge, and with it came at least the potential to retreat into academic isolation.

▲13

In fact, however, the majority of scientists continued to see communication with the public as part of their duty. For some, lecturing and popular writing were an important part of their professional identity, and there was also a wide penumbra of individuals who had some level of expertise but who functioned mainly as communicators. There were huge public disagreements over the nature and function of science, to say nothing of controversial theoretical developments, and communication was essential if professional scientists were to have influence on these debates. Was science based on fact-gathering or conceptual insights; was it primarily theoretical or practical; was it at the service of the government, industry, or the people? How should one respond to the wider religious (➔ Media Link #az) and moral issues raised by materialism in biology or atomism in physics? All of these issues would be debated by scientists and their critics in the public domain.

▲14

New work in the physical sciences became increasingly too technical for the general reader to comprehend. Still, in fields such as biology or geology it was still possible to present new scientific theories in a format that was accessible to any educated reader. Books such as Charles Lyell's (1797–1875) (➔ Media Link #b0) *Principles of Geology*[8] and Charles Darwin's (1809–1882) (➔ Media Link #b1) *On the Origin of Species* (➔ Media Link #b2)[9] belong to this category, reaching the public through the use of evidence visible to anyone with an interest in the natural world. Neither Lyell nor Darwin was a professional scientist in the modern sense, but we should not assume that those who did earn their living from science were any less anxious to participate in the debates sparked by new ideas. Thomas Henry Huxley (1825–1895) (➔ Media Link #b3) and Ernst Haeckel (1834–1919) (➔ Media Link #b4) both lectured (➔ Media Link #b5) and wrote widely for the general public to promote the case for evolutionism. Haeckel, like Darwin and many other scientists, sought to engage the public by writing about the natural world, and their accounts were increasingly accompanied by lavish illustrations. Huxley was also one of the small but growing band of professional scientists who argued for greater government support for science, so here, too, his popular writing was part of an ideological campaign. In Germany, the assumption that science was an integral part of a balanced cultural identity encouraged scientists to present their ideas at a level accessible to all middle-class readers.[10]

▲15

Much of this literature was aimed at an educated audience and was published in formats that only the relatively prosperous could afford. But as the technology of printing improved, it became possible to publish books and periodicals at prices that made them available to ordinary people. Here was a much broader battleground on which debates over the significance of science could be fought out.[11] Conservative thinkers, for instance, wanted to preserve the worldview of natural theology in which science was thought to confirm the existence of a creator, and movements such as the Society for the Promotion of Christian Knowledge made such material available to a wide public through books, pamphlets, and cheap magazines. The Scottish stonemason turned geologist Hugh Miller (1802–1856) (➔ Media Link #b6) wrote popular books promoting the idea that the history of the earth represented the unfolding of a divine plan. Many of the writers promoting natural theology were women, often with some connection to active scientists. Arabella Burton Buckley (1840–1929) (➔ Media Link #b7), who had been Lyell's secretary, continued to be active in this area into the later decades of the century, tirelessly promoting an alternative to Darwinian materialism.

▲16

These writers were anxious to combat the radicals who saw new scientific ideas as an opportunity to challenge the status quo. As early as the 1820s, evolutionism flourished. It was mainly propagated through cheap periodicals with a subversive political agenda. The Edinburgh publisher Robert Chambers (1802–1871) (➔ Media Link #b8) published his *Vestiges of the Natural History of Creation (➔ Media Link #b9)* [12] anonymously in 1844 in an effort to persuade the middle classes that evolutionism was compatible with religion. He was widely condemned by conservative thinkers, including Miller, whose *Footprints of the Creator (➔ Media Link #ba)*[13] sold even more copies than *Vestiges*. Still, recent research suggests that Chambers' book did have an impact that prepared the way for Darwin.[14] Later in the century, books by Darwin, Huxley, and Haeckel were issued in cheap editions by organisations such as the Rationalist Press Association. At the same time, however, there were efforts to resist the growing authority of the professional scientists. The astronomer Richard A. Proctor (1837–1888) (➔ Media Link #bb) founded a magazine, *Knowledge*, in 1881[15] to convince amateur observers that they could still contribute to the development of science. This distrust of the elite professionals was even more apparent in the United States, where the ability of the common man to decide on the veracity of scientific claims was hailed as a bulwark against the dominion of academically-trained experts. *Scientific American* (➔ Media Link #bc)[16] emerged as a magazine catering to the many ordinary people with some interest in technology and applied science (but not necessarily in academic science).

▲17

Across Europe, the very different cultural environments prevailing in the various nations conditioned the ways in which science was perceived. In France and the German-speaking lands, there was a strong interest in science and technology promoted by those who wanted to encourage rationalism and industrialisation.[17] French authors such as Camille Flammarion (1842–1925) (➔ Media Link #bd) and Louis Figuier (1819–1894) (➔ Media Link #be) wrote popular books – the latter's work being renowned for its illustrations (➔ Media Link #bf) of prehistoric life – that were translated into many languages. The science fiction novels of Jules Verne (1828–1905) (➔ Media Link #bg) also helped to promote an interest in both natural history and technical innovation. They often prefigured developments that would come to fruition in later decades. Besides, we have already noted the success of the German biologist Ernst Haeckel's descriptions of the evolution of life on earth. However, Haeckel's books were also part of his campaign to promote a particular ideology based on his philosophy of monism (and contained implications on the relationship between the human races that we find disturbing today). Science was often presented as a tool of modernisation – but there were contested ideas about what modernisation meant, and not everyone thought it was a good idea. Popular writing was thus a field on which the competing ideologies fought their battles. In countries where industrialisation was slow or non-existent, including southern Europe and South America, radicals called for more science education, whereas conservative forces were suspicious and were often able to limit the spread of ideas they saw as dangerous, such as evolutionism.

▲18

These points remind us that despite the trend toward professionalisation, the boundary between the professional scientist and the wider community was by no means a sharp one. Different groups had conflicting ideas on who should determine what counted as science. Even at the highest level, gentleman amateurs such as Darwin continued to have influence, whereas Huxley and his allies were promoting the need for more professionals. Popular lectures and exhibitions had become an important means of spreading science in the previous century, but they became even more influential in the 19th, especially after the emergence of international events following the success of the Great Exhibition of 1851 (➔ Media Link #bh) in London (➔ Media Link #bi). On a smaller scale, galleries such as the Royal Polytechnic Institution brought science to the paying public – but all such institutions and events had to present the material in a way that interested ordinary people.

▲19

This meant that display techniques and showmanship were crucial, and the topics covered had to reflect public interest even if this did not coincide with the values of the scientific elite.[18] Topics such as phrenology and mesmerism – dismissed as pseudoscience (➔ Media Link #bj)by the elite – were hugely popular and clearly perceived as science by the general public.[19] Nor was there a sharp division between the elite and the showmen – Michael Faraday's (1791–1867) (➔ Media Link #bk) reputation as a scientist rested as much on the success of his spectacular lectures at the Royal Institution as on his electromagnetic discoveries. Natural history museums and zoological gardens also increasingly had to cater to a wider public that was eager to learn, but needed to be encouraged by displays emphasising the wonders of the natural world. By the end of the century, museum presentations were being designed employing the latest techniques used in department stores.

▲20

The 20th Century: Technology and the Ivory Tower

The expansion of mass-market publishing continued in the 20th century with the creation of an ever-larger range of newspapers and magazines (➔ Media Link #bl), some now with readerships in the millions. Simultaneously, an increasing proportion of the population in the industrialised world now received some secondary education. However, access to higher levels of education was limited, which created a market for low-priced literature aimed at those seeking informal education through home reading, libraries, or extra-mural institutions. If publishers could strike the right balance between popular interest and education, they could achieve considerable sales with book series, serial works, and magazines. In Britain, where this market was particularly active, there were educational book series such as the Home University Library (founded 1911) and Benn's Sixpenny Library (founded 1926). Such series usually contained a significant proportion of books on science. Works such as *The Science of Life*[20] by H.G. Wells (1866–1946) (➔ Media Link #bm) and Julian Huxley (1887–1975) (➔ Media Link #bn), issued in fortnightly parts 1929–1930 and then republished in book form, did sell hundreds of thousands of copies.[21]

▲21

There were, however, significant differences between the ways in which this market operated in different countries. In America, for instance, there seems to have been no equivalent to the rapid expansion of self-education literature seen in Britain before World War I. On the other hand, popular magazines on science and technology such as *Scientific American* and *Kosmos*[22] (➔ Media Link #bo) in Germany flourished (the latter was selling two hundred thousand copies a month in the 1920s) – yet British equivalents such as *Conquest* and *Armchair Science*[23] were never very successful.[24]

▲22

The question of who actually wrote the material in these books and magazines has provoked some controversy, at least in the English-speaking world. For a time, it was assumed that it was at this point that the scientific community achieved sufficient professional standing that it could afford to turn its back on popular communication, retreating into an ivory tower and expecting dedicated science writers and correspondents to do the job on its behalf. It became harmful to a professional scientist's career if he was seen to be wasting research time writing for the public. Julian Huxley, for instance, was warned in the 1920s that his popular writing was harming his chances of getting elected to the Royal Society. Still, this image is a distortion, created in part by left-wing scientists such as Lancelot Hogben (1895–1975) (➔ Media Link #bp) in the mid-20th century, who considered their own ideologically loaded efforts to raise awareness of how science was being misused by industry and governments to be the only valid form of popular science writing.

▲23

In fact, Julian Huxley was only one of many active scientists who spent a significant amount of time and effort seeking to elicit public interest in science and to shape public attitudes toward it. Evolution was not the only topic, but it aroused wide interest because of its broader implications. Arthur Stanley Eddington (1882–1944) (➔ Media Link #bq), for instance, achieved a high profile through his efforts to explore the religious dimension of new developments in physics and cosmology.[25] James Hopwood Jeans's (1877–1946) (➔ Media Link #br) *The Mysterious Universe* of 1930 followed a similar line of thought. It was advertised on the London underground and sold 140,000 copies. Eddington and Jeans were criticised for their promotion of the idea that the new physics was consistent with belief in a God who had designed the universe along mathematical lines. At the same time, in America, the scientific community actively sought to re-establish its influence on popular science writing during the 1920s.[26]

▲24

Professional scientists were not the only authors writing for a general audience, of course. There were still many writers who specialised in this area, often because they had some links with academic or industry-based scientists. There were fewer female authors at the beginning of the 20th century, perhaps because a large proportion of what was perceived as "popular science" was concerned with applied science and technology. Science magazines, in the English-speaking world at least, devoted relatively little space to theoretical innovations even in areas such as atomic physics where major breakthroughs were being made. Professional scientists and engineers relied on writers who had good contacts with industry to present a positive image of their work.

▲25

Figures such as Charles Robert Gibson (1870–1931) (➔ Media Link #bs) produced large numbers of books on technical matters for a general audience, often including teenagers. Gibson was actually the manager of a carpet factory, but he had extensive connections with engineers and with the teachers at his local technical college in Glasgow. Such writers saw the promotion of science as something that would help ordinary people understand the new technologies, such as radio, that were transforming their lives – and might even help them get a better job. The positive, economy-friendly image of technical progress they created was, however, challenged in the 1930s by a new generation of scientists with left-wing political beliefs. Scientists such as Lancelot Hogben and J.B.S. Haldane (1892–

1964) (➔ Media Link #bt) saw it as their duty to educate the public about science in order to make them understand how it was being used to control their lives. Around Europe, science was popularised in many different forms as the century progressed, depending on the local social and cultural environment and ideological shifts.[27]

▲26

In the first half of the century, there were few scientists who wrote regularly for the daily newspapers, and few newspapers which employed science columnists. This level of communication offered particular challenges because of the need both to simplify and to catch the attention of ordinary readers. In America, a science news syndicate, Science Service, was established as early as 1921, but it had limited success. In Britain, there was only a handful of science columnists by the time of World War II, and the *Manchester Guardian*'s columnist J.G. Crowther (1899–1973) (➔ Media Link #bu) saw himself as more or less creating a new profession as he built his career. The problems of communicating science to a mass audience demanding entertainment rather than information became even more intense as the new media (➔ Media Link #bv) of film, radio, and later television became available.[28]

▲27

In countries such as Britain, where the state controlled the airwaves, science could be inserted into programmes "in the public interest", even though the public was often not very appreciative. But where commercial interests governed programming, as in America, it became harder for the scientific community to control what kind of – if any– science was broadcasted. By the 1950s, as television took over, it became virtually impossible for the ordinary scientist to determine the content of science programmes. A few became media stars, including Jacob Bronowski (1908–1974) (➔ Media Link #bw) in Britain and Carl Sagan (1934–1996) (➔ Media Link #bx) in America, but for the most part the scientists were reduced to a passive status, being merely interviewed by presenters whose main concern was capturing the audience rather than representing the scientific community. Scientists such as Sagan who did gain a high profile were sometimes criticised by their colleagues for turning their backs on research. They were thus dismissed as dilettantes who cared more for presentation than substance.

▲28

The scientific community may have been temporarily persuaded that it should abandon public communication and leave science writing and broadcasting to those who specialised in those media. As the left-wingers of the 1930s and 1940s were eclipsed during the Cold War, it seemed reasonable to assume that the media would go back to presenting a mostly positive image of what science and technology had to offer. Still, there were already signs that the public was by no means convinced that all scientific developments had positive social applications. The use of atomic bombs at the end of World War II provoked a flurry of criticism aimed at the scientific community (an attitude shared by some of the scientists themselves), and this concern expanded as the nuclear arms-race took off in the 1950s. Soon, other areas of concern were emerging, including the destruction of the environment by pesticides and the side-effects of new medical procedures.

▲29

If the scientists had hoped that the science writers would respond to the public's concerns on their behalf, they were soon disappointed. In fact, there were complaints that the media's involvement with popular science demeaned the activities of the scientific community. Nevertheless, it was evident that the media were more concerned with entertainment than education, and this required some element of trivialisation as well as the need to respond to public concerns.[29] In response, the scientists once again tried to get involved with the media, calling for better "public understanding of science". Yet, such a top-down model of dissemination could no longer work, and modern attitudes began to focus much more on direct engagement with public interests.

▲30

In this respect, these modern concerns are reminiscent of the situation that prevailed in earlier periods, when scientists were forced by the insecure status of their profession to engage more actively with the general public. Our survey has suggested that there was no automatic drive toward isolationism as science became professionalised. When the first generations of professionals were active, it was still necessary for them to justify their work by appealing to the public, and there were internal disagreements about the nature, purpose, and implications of science that they were anxious to thrash out in a wider cultural arena. Only in the mid-20th century did science briefly attain a status which encouraged its practitioners to think they could ignore wider responses to their work – and they were very soon made aware of their mistake.

▲31

Peter J. Bowler, Belfast

Appendix

Sources

Bradley, A. Percy (ed.): Armchair Science, London 1929–1940, vol. 1–12.

Chambers, Robert: Vestiges of the Natural History of Creation, London 1860 [1844], online: http://archive.org/details/vestigesofnatura1860cham [29/07/2013].

Darwin, Charles: The Origin of Species, New York 1909 [1859], online: http://archive.org/details/originofspecies00darwuoft [29/07/2013].

Diderot, Denis et al. (eds.): Encyclopédie ou Dictionnaire raisonné des sciences, des arts et des métiers, Paris 1751–1780, vol. 1–35, online: http://portail.atilf.fr/encyclopedie/ [29/07/2013].

Galilei, Galileo: The Dialogue Concerning the Two Chief World Systems, translated by Thomas Salusbury, without place 1661, online: http://archimedes.mpiwg-berlin.mpg.de/cgi-bin/toc/toc.cgi?step=thumb&dir=galil_syste_065_en_1661 [29/07/2013]. (Italian Original: Dialogo sopra i due massimi sistemi del mondo, Florence 1632.)

Jeans, James Hopwood: The Mysterious Universe, Cambridge 1930.

Lyell, Charles: Principles of Geology, London 1837, online: http://archive.org/details/Lyell1837jf09J-d [29/07/2013].

Miller, Hugh: Footprints of the Creator Or, the Asterolepis of Stromness, Edinburgh 1872, online: http://archive.org/details/footprintscreat01millgoog [29/07/2013].

Proctor, Richard A. (ed.): Knowledge & Illustrated Scientific News, London 1881–1904, vol. 1–27.

Scientific American, Inc. (eds.): Scientific American, 1845–[forthcoming], vol. 2–14 and New Series vol. 1–21 online: http://ebooks.library.cornell.edu/s/scia/index.html [29/07/2013].

Vetter, B. (ed.) Kosmos: Zeitschrift für die gesamte Entwickelungslehre, Stuttgart 1879–1886, vol. 1–19, vol. 1 online: http://archive.org/details/kosmos16171885leip [21/08/2013].

Wells, Herbert George / Huxley, Julian / Wells, George Philip: The Science of Life, 1929–1930, vol. 1–3, vol. 1 online: http://www.unz.org/Pub/WellsHG-1931 [21/08/2013].

Literature

Bensaude-Vincent, Bernadette: La science contre l'opinion: Histoire d'un divorce, Paris 2003.

idem: La science populaire dans la presse et l'édition: XIXe et XXe siècles, Paris 1997.

Boon, Timothy: Films of Fact: A History of Science in Documentary Films and Television, London 2007.

Bowler, Peter John: Science for All: The Popularization of Science in Early Twentieth-Century Britain, Chicago, IL et al. 2009.

Broks, Peter: Understanding Popular Science, Maidenhead 2006.

Burnham, John: How Superstition Won and Science Lost: Popularizing Science and Health Care in the United States, New Brunswick, NJ 1987.

Cooter, Roger: The Cultural Meaning of Popular Science: Phrenology and the Organization of Consent in Nineteenth-Century Britain, Cambridge et al. 1984.

Cooter, Roger / Pumphrey, Stephen: Separate Spheres and Public Places: Reflections on the History of Science Popularization and on Science in Popular Culture, in: History of Science 32 (1994), pp. 232–267.

Daum, Andreas W.: Wissenschaftspopularisierung im 19 Jahrhundert: Bürgerliche Kultur, naturwissenschaftliche Bildung und die deutsche Öffentlichkeit, 1848–1914, 2nd ed., Munich 2002.

Eidelman, Jacqueline: The Cathedrals of French Science: The Early Years of the Palais de la Decouverte, in: Terry Shinn et al. (eds.): Expository Science: Forms and Functions of Popularization, Dordrecht et al. 1985, pp. 195–207.

Fara, Patricia: Erasmus Darwin: Sex, Science and Serendipity. Oxford 2012.

Fyfe, Aileen: Science and Salvation: Evangelical Popular Science Publishing in Victorian Britain, Chicago, IL 2004.

idem: Steam-Powered Knowledge: William Chambers and the Business of Publishing, 1820–1860, Chicago, IL 2012.

Gregory, Jane / Miller, Steve: Science in Public: Communication, Culture and Credibility, Cambridge, MA 2000.

Golinski, Jan: Science and Public Culture: Chemistry and the Enlightenment in Britain, 1760–1820, Cambridge et al. 1992.

Hillgartner, Stephen: The Dominant View of Popularization: Conceptual Problems, Political Uses, in: Social Studies of Science 20 (1990), pp. 519–539.

Kirby, David: Lab-Coats in Hollywood: Science, Scientists and Cinema, Cambridge, MA 2011.

La Follette, Marcel: Making Science Our Own: Public Images of Science, 1910–1955, Chicago, IL et al. 1990.

idem: Science on the Air: Popularizers and Personalities on Radio and Early Television, Chicago, IL et al. 2008.

Lightman, Bernard V.: Victorian Popularizers of Science: Designing Nature for New Audiences, Chicago, IL et al. 2007.

Morus, Iwan Rhys: Frankenstein's Children: Electricity, Exhibition and Experiment in Early Nineteenth-Century London, Princeton, NJ 1998.

Papanelopoulou, Faidra et al. (eds.): Popularizing Science and Technology in the European Periphery, 1800–2000, Farnham 2009.

Park, Katherine et al. (eds.): Early Modern Science, Cambridge 2006 (The Cambridge History of Science 3).

Porter, Roy (ed.): The Eighteenth Century, Cambridge 2003 (The Cambridge History of Science 4).

Schirrmacher, Arne: From Kosmos to Koralle: The Culture of Science Reading in Imperial and Weimar Germany, in: Catherine Carsonet al. (eds.): Weimar Culture and Quantum Mechanics: Selected Papers by Paul Forman and Contemporary Perspectives on the Forman Thesis, London et al. 2011, pp. 43–52.

Secord, James A.: Victorian Sensation: The Extraordinary Publication, Reception and Secret Authorship of Vestiges of the Natural History of Creation, Chicago, IL et al. 2000.

Shinn, Terry et al. (eds.): Expository Science: Forms and Functions of Popularization, Dordrecht et al. 1985.

Stewart, Larry: The Rise of Public Science: Rhetoric, Technology, and Natural Philosophy in Newtonian Britain, Cambridge et al. 1992.

Tobey, Ronald: The American Ideology of National Science, 1919–1930, Pittsburgh, PA 1971.

Whitley, Richard: Knowledge Producers and Knowledge Acquirers: Popularization and a Relation between Science Fields and their Publics, in: Terry Shinn et al. (eds.): Expository Science: Forms and Functions of Popularization, Dordrecht et al. 1985, pp. 3–28.

Whitworth, Michael: The Clothbound Universe: Popular Physics Books, 1919–1930, in: Publishing History 40 (1996), pp. 52–82.

Winter, Alison: Mesmerized: Powers of Mind in Victorian Britain, Chicago, IL 1998.

Notes

1. ^ Broks, Understanding Popular Science 2006; Cooter / Pumphrey, Separate Spheres 1994; Gregory / Miller, Science in Public 2000; Hillgartner, The Dominant View 1990; Whitley, Knowledge Producers 1985.
2. ^ Galileo, Dialogue 1661, http://archimedes.mpiwg-berlin.mpg.de/cgi-bin/toc/toc.cgi?step=thumb&dir=galil_syste_065_en_1661.
3. ^ Park / Daston, Early Modern Science 2006.
4. ^ Golinski, Science in Public Culture 1992; Stewart, The Rise 1992.
5. ^ Porter, The Eighteenth Century 2003.
6. ^ Diderot / D'Alembert, Encyclopédie 1751–1780, vol. 1–35. http://portail.atilf.fr/encyclopedie/
7. ^ Fara, Erasmus Darwin 2012.

8. ^ Lyell, Principles 1837. http://archive.org/details/Lyell1837jf09J-d
9. ^ Darwin, Origin 1859. http://archive.org/details/originofspecies00darwuoft.
10. ^ Daum, Wissenschaftspopularisierung 2002.
11. ^ Fyfe, Science and Salvation 2004; idem, Steam-Powered Knowledge 2012; Lightman, Victorian Popularizers 2007.
12. ^ Chambers, Vestiges 1860 [1844]. http://archive.org/details/vestigesofnatura1860cham.
13. ^ Miller, Footprints 1872. http://archive.org/details/footprintscreat01millg00g
14. ^ Secord, Victorian Sensation 2000.
15. ^ See Proctor, Knowledge 1881–1904, vol. 1–27.
16. ^ Scientific American 1845–[forthcoming]. http://ebooks.library.cornell.edu/s/scia/
17. ^ Bensaude-Vincent, La science populaire 1997; idem, La science contre l'opinion 2003; Eidelman, Cathedrals 1985; Daum, Wissenschaftspopularisierung 2002.
18. ^ Morus, Frankenstein's Children 1998.
19. ^ Cooter, The Cultural Meaning 1984; Winter, Mesmerized 1998.
20. ^ Wells / Huxley, Science of Life 1929–1930. http://www.unz.org/Pub/WellsHG-1931
21. ^ Bowler, Science for All 2009, chapter 8.
22. ^ Vetter, Kosmos 1879–1886, vol. 1–19. http://archive.org/details/kosmos16171885leip
23. ^ Bradley, Armchair Science 1929–1940, vol. 1–12.
24. ^ ibidem, chapter 9; Schirmacher, From Kosmos 2011.
25. ^ Whitworth, The Clothbound Universe 1996.
26. ^ La Follette, Making Science 1990; Tobey, The American Ideology 1971.
27. ^ Papanelopoulou, Popularizing Science 2009.
28. ^ Boon, Films of Fact 2007; Kirby, Lab-Coats 2011; La Follette, Science on the Air 2008.
29. ^ Burnham, How Superstition Won 1987; Broks, Understanding Popular Science 2006; Gregory / Miller, Science in Public 2000.

Editor: Paul Ziche
Copy Editor: Christina Müller

Eingeordnet unter:
Crossroads › Wissensräume* › Popularisation of Science
Crossroads › Knowledge Spaces* › Popularisation of Science

Indices

DDC: 001 , 070 , 500 , 600

Locations

America DNB (http://d-nb.info/gnd/4001670-5)
Birmingham DNB (http://d-nb.info/gnd/4006934-5)
Edinburgh DNB (http://d-nb.info/gnd/4013557-3)
Europe DNB (http://d-nb.info/gnd/4015701-5)
France DNB (http://d-nb.info/gnd/4018145-5)
Germany DNB (http://d-nb.info/gnd/4011882-4)
Glasgow DNB (http://d-nb.info/gnd/4021159-9)
Holy Roman Empire (-1806) DNB (http://d-nb.info/gnd/2035457-5)
London DNB (http://d-nb.info/gnd/4074335-4)
Netherlands DNB (http://d-nb.info/gnd/4042203-3)
Paris DNB (http://d-nb.info/gnd/4044660-8)

Scandinavia DNB (http://d-nb.info/gnd/4055209-3)
Scotland DNB (http://d-nb.info/gnd/4053233-1)
South America DNB (http://d-nb.info/gnd/4078014-4)
Southern Europe DNB (http://d-nb.info/gnd/4078023-5)
United Kingdom DNB (http://d-nb.info/gnd/4022153-2)
United States DNB (http://d-nb.info/gnd/4078704-7)

Citation

Bowler, Peter: The Popularisation of Science, in: European History Online (EGO), published by the Leibniz Institute of European History (IEG), Mainz 2015-10-22. URL: http://www.ieg-ego.eu/bowlerp-2015-en URN: urn:nbn:de:0159-2015101603 [YYYY-MM-DD].

When quoting this article please add the date of your last retrieval in brackets after the url. When quoting a certain passage from the article please also insert the corresponding number(s), for example 2 or 1-4.

Export citation from: HeBIS Online Catalogue (http://cbsopac.rz.uni-frankfurt.de/DB=2.1/PPNSET?PPN=365601985) WorldCat (http://www.worldcat.org/oclc/926027441)

Link #ab
- Science (http://www.ieg-ego.eu/en/threads/backgrounds/science/paul-ziche-joppe-van-driel-science)

Link #ac
- Industrialization (http://www.ieg-ego.eu/en/threads/backgrounds/industrialization/richard-h-tilly-industrialization-as-an-historical-process)

Link #ad
- Modernization (http://www.ieg-ego.eu/en/threads/models-and-stereotypes/modernization/thomas-mergel-modernization)

Link #ae
- Galileo Galilei (1564–1642) VIAF (http://viaf.org/viaf/2470550) DNB (http://d-nb.info/gnd/118537229) ADB/NDB (http://www.deutsche-biographie.de/pnd118537229.html)

Link #af
- Isaac Newton (1642–1727) VIAF (http://viaf.org/viaf/22146457) DNB (http://d-nb.info/gnd/118587544) ADB/NDB (http://www.deutsche-biographie.de/pnd118587544.html)

Link #ag
- Cosimo II of Tuscany (1590–1621) VIAF (http://viaf.org/viaf/51663930) DNB (http://d-nb.info/gnd/124843778) ADB/NDB (http://www.deutsche-biographie.de/pnd124843778.html)

Link #ah
- Johannes Kepler (1571–1630) VIAF (http://viaf.org/viaf/41842150) DNB (http://d-nb.info/gnd/118561448) ADB/NDB (http://www.deutsche-biographie.de/pnd118561448.html)

Link #ai
- Literacy (http://www.ieg-ego.eu/en/threads/backgrounds/literacy/robert-a-houston-literacy)

Link #aj
- Translation (http://www.ieg-ego.eu/en/threads/backgrounds/translation/mary-snell-hornby-juergen-f-schopp-translation)

Link #al

- William Derham (1657–1735) VIAF (http://viaf.org/viaf/51739997) DNB (http://d-nb.info/gnd/128644974) ADB/NDB (http://www.deutsche-biographie.de/pnd128644974.html)

Link #am

- Francis Bacon (1561–1626) VIAF (http://viaf.org/viaf/31992319) DNB (http://d-nb.info/gnd/118505696) ADB/NDB (http://www.deutsche-biographie.de/pnd118505696.html)

Link #ao

- Haskalah Movement (http://www.ieg-ego.eu/en/threads/european-networks/jewish-networks/marie-schumacher-brunhes-enlightenment-jewish-style-the-haskalah-movement-in-europe)

Link #aq

- Denis Diderot (1713–1784) VIAF (http://viaf.org/viaf/54146831) DNB (http://d-nb.info/gnd/118525263) ADB/NDB (http://www.deutsche-biographie.de/pnd118525263.html)

Link #ar

- Jean Le Rond d'Alembert (1717–1783) VIAF (http://viaf.org/viaf/46756283) DNB (http://d-nb.info/gnd/11850178X) ADB/NDB (http://www.deutsche-biographie.de/pnd11850178X.html)

Link #as

- John Theophilus Desaguliers (1683–1744) (http://viaf.org/viaf/37090620/)
-  (http://www.ieg-ego.eu/en/mediainfo/john-theophilus-desaguliers)
  John Theophilus Desaguliers (1683–1744)

Link #at

-  (http://www.ieg-ego.eu/de/mediainfo/soho-house)
  Soho House

Link #au

- James Watt (1736–1819) VIAF (http://viaf.org/viaf/22269445) DNB (http://d-nb.info/gnd/118629484) ADB/NDB (http://www.deutsche-biographie.de/pnd118629484.html)

Link #av

- Erasmus Darwin (1731–1802) VIAF (http://viaf.org/viaf/7419078) DNB (http://d-nb.info/gnd/118671049) ADB/NDB (http://www.deutsche-biographie.de/pnd118671049.html)

Link #aw

- Joseph Priestley (1733–1804) VIAF (http://viaf.org/viaf/120696744) DNB (http://d-nb.info/gnd/118793357) ADB/NDB (http://www.deutsche-biographie.de/pnd118793357.html)

Link #ax

- Book Market (http://www.ieg-ego.eu/en/threads/backgrounds/the-book-market/ernst-fischer-the-book-market)

Link #ay

- Laboratory (http://www.ieg-ego.eu/en/threads/crossroads/knowledge-spaces/henning-schmidgen-laboratory)

-  (http://www.ieg-ego.eu/en/mediainfo/analytical-laboratory-in-giessen-1842)
  Analytical Laboratory in Giessen, 1842

Link #az

- Religious and Confessional Spaces (http://www.ieg-ego.eu/en/threads/crossroads/religious-and-confessional-spaces/heinrich-richard-schmidt-religious-and-confessional-spaces)

Link #b0

- Charles Lyell (1797–1875) VIAF (http://viaf.org/viaf/68999334) DNB (http://d-nb.info/gnd/118575538) ADB/NDB (http://www.deutsche-biographie.de/pnd118575538.html)

Link #b1

- Charles Darwin (1809–1882) VIAF (http://viaf.org/viaf/27063124) DNB (http://d-nb.info/gnd/118523813) ADB/NDB (http://www.deutsche-biographie.de/pnd118523813.html)
-  (http://www.ieg-ego.eu/en/mediainfo/charles-darwin-180920131882)
  Charles Darwin (1809–1882)

Link #b2

-  (https://archive.org/details/originofspecies00darwuoft)
  On the Origin of Species at archive.org

Link #b3

- Thomas Henry Huxley (1825–1895) VIAF (http://viaf.org/viaf/66511085) DNB (http://d-nb.info/gnd/118555103) ADB/NDB (http://www.deutsche-biographie.de/pnd118555103.html)

Link #b4

- Ernst Haeckel (1834–1919) VIAF (http://viaf.org/viaf/73923565) DNB (http://d-nb.info/gnd/118544381) ADB/NDB (http://www.deutsche-biographie.de/pnd118544381.html)

Link #b5

-  (http://www.ieg-ego.eu/en/mediainfo/address-by-ernst-haeckel-in-the-volkshaus-in-jena-in-1907)
  Address by Ernst Haeckel in the Volkshaus in Jena in 1907

Link #b6

- Hugh Miller (1802–1856) VIAF (http://viaf.org/viaf/61631007) DNB (http://d-nb.info/gnd/119384051) ADB/NDB (http://www.deutsche-biographie.de/pnd119384051.html)

Link #b7

- Arabella Burton Buckley (1840–1929) VIAF (http://viaf.org/viaf/13359176) DNB (http://d-nb.info/gnd/128341580)

Link #b8

- Robert Chambers (1802–1871) VIAF (http://viaf.org/viaf/61590299) DNB (http://d-nb.info/gnd/119391279) ADB/NDB (http://www.deutsche-biographie.de/pnd119391279.html)

Link #b9

- 

(https://archive.org/details/vestigesofnatura1860cham)
Vestiges of the Natural History of Creation

Link #ba

- 
(https://archive.org/details/footprintscreat01millgoog)
Footprints of the Creator

Link #bb

- Richard A. Proctor (1837–1888) VIAF (http://viaf.org/viaf/71487031) DNB (http://d-nb.info/gnd/1021280755)

Link #bc

- 

(http://www.ieg-ego.eu/en/mediainfo/scientific-american)
Scientific American

Link #bd

- Camille Flammarion (1842–1925) VIAF (http://viaf.org/viaf/12308308) DNB (http://d-nb.info/gnd/119223007) ADB/NDB (http://www.deutsche-biographie.de/pnd119223007.html)

Link #be

- Louis Figuier (1819–1894) VIAF (http://viaf.org/viaf/39376961) DNB (http://d-nb.info/gnd/116501936) ADB/NDB (http://www.deutsche-biographie.de/pnd116501936.html)

Link #bf

- 
(http://www.ieg-ego.eu/en/mediainfo/appearance-of-man)
Appearance of Man

Link #bg

- Jules Verne (1828–1905) VIAF (http://viaf.org/viaf/76323989) DNB (http://d-nb.info/gnd/118626620) ADB/NDB (http://www.deutsche-biographie.de/pnd118626620.html)

Link #bh

- Weltausstellungen (http://www.ieg-ego.eu/de/threads/crossroads/wissensraeume/alexander-c-t-geppert-weltausstellungen)

Link #bi

-  (http://www.ieg-ego.eu/en/mediainfo/opening-of-the-first-world-exhibition-in-london-1851) Opening of the First World Exhibition in London, 1851

Link #bj

- Pseudoscience (http://www.ieg-ego.eu/en/threads/crossroads/knowledge-spaces/ute-frietsch-the-boundaries-of-science-pseudoscience)

Link #bk

- Michael Faraday (1791–1867) VIAF (http://viaf.org/viaf/38158158) DNB (http://d-nb.info/gnd/118531921) ADB/NDB (http://www.deutsche-biographie.de/pnd118531921.html)

Link #bl

- Journalism (http://www.ieg-ego.eu/en/threads/european-media/journalism/juergen-wilke-journalism)

Link #bm

- Herbert George Wells (1866–1946) VIAF (http://viaf.org/viaf/97006424) DNB (http://d-nb.info/gnd/118643266) ADB/NDB (http://www.deutsche-biographie.de/pnd118643266.html)

Link #bn

- Julian Huxley (1887–1975) VIAF (http://viaf.org/viaf/39451154) DNB (http://d-nb.info/gnd/11855509X) ADB/NDB (http://www.deutsche-biographie.de/pnd11855509X.html)

Link #bo

- 

(https://archive.org/details/kosmos16171885leip) Kosmos

Link #bp

- Lancelot Hogben (1895–1975) VIAF (http://viaf.org/viaf/85167517) DNB (http://d-nb.info/gnd/121363430) ADB/NDB (http://www.deutsche-biographie.de/pnd121363430.html)

Link #bq

- Arthur Stanley Eddington (1882–1944) VIAF (http://viaf.org/viaf/24675918) DNB (http://d-nb.info/gnd/118681591) ADB/NDB (http://www.deutsche-biographie.de/pnd118681591.html)

Link #br

- James Hopwood Jeans (1877–1946) VIAF (http://viaf.org/viaf/36999529) DNB (http://d-nb.info/gnd/105857807) ADB/NDB (http://www.deutsche-biographie.de/pnd105857807.html)

Link #bs

- Charles Robert Gibson (1870–1931) VIAF (http://viaf.org/viaf/50655738) DNB (http://d-nb.info/gnd/116616792) ADB/NDB (http://www.deutsche-biographie.de/pnd116616792.html)

Link #bt

- John Burdon Sanderson Haldane (1892–1964) VIAF (http://viaf.org/viaf/61606828) DNB (http://d-nb.info/gnd/119013436) ADB/NDB (http://www.deutsche-biographie.de/pnd119013436.html)

Link #bu

- James Gerald Crowther (1899–1973) VIAF (http://viaf.org/viaf/84483118) DNB (http://d-nb.info/gnd/128932759) ADB/NDB (http://www.deutsche-biographie.de/pnd128932759.html)
-  (http://www.ieg-ego.eu/en/mediainfo/james-gerald-crowther-189920131973) James Gerald Crowther (1899–1973)

Link #bv

- Media Genres (http://www.ieg-ego.eu/en/threads/backgrounds/media-genres/juergen-wilke-media-genres)

Link #bw

- Jacob Bronowski (1908–1974) VIAF (http://viaf.org/viaf/54274208) DNB (http://d-nb.info/gnd/124198074) ADB/NDB (http://www.deutsche-biographie.de/pnd124198074.html)

Link #bx

- Carl Sagan (1934–1996) VIAF (http://viaf.org/viaf/36997809) DNB (http://d-nb.info/gnd/115873937) ADB/NDB (http://www.deutsche-biographie.de/pnd115873937.html)

http://www.ieg-ego.eu ISSN 2192-7405