A genealogy of the increasing gap between science and the public

Bernadette Bensaude-Vincent

Surveys of the public understanding of science lament the communication gap between scientists and the public. This paper provides a conceptual analysis of the gap that leads to diversifying the notion of “public.” The paper traces the specific context in which the notion of the gap originated, looking especially at the importance of twentieth-century physics in shaping that context.

Periodically, surveys of the public understanding of science lament the communication gap between scientists and the public. A large portion of the population both in the United States and European does not understand the basics of science and consequently cannot grasp the social impact of scientific discoveries. It is repeatedly argued that this state of affairs calls for mediators to bring these two worlds closer together.¹

While all the attention is concentrated on the process of communicating science—on improving the quality of scientific journalism, on training scientists to be more media-oriented and on giving better access to databases—the evidence of the gap itself is seldom questioned.² It is taken for granted that the rapid advances of scientific research, coupled with its increasing specialization and more technical language, deepen the gulf between the scientists and the lay public. Therefore, the need for public communication of science is a side effect of scientific creativity. It is a political duty in democratic societies to inform the citizens. It seems equally obvious that science communication is a distinct activity from science production. Whereas the latter is aimed at the advancement of knowledge, the former is aimed at bridging the distance between science and the public. This public communication of science is a secondary activity based on pre-existing, well-established scientific results. It is often described as a translation of scientific language into ordinary language. In all cases it is conceived of as a one-way flux of information, stemming from scientists and flowing down to a receptive public through the various channels of modern media.

It is the evidence of an increasing gap that is the focus of this paper. The purpose is first to clarify the notion through a conceptual analysis that will lead to diversifying the notion of public. A second purpose is to trace the specific context in which the notion of the gap originated.

1. Two kinds of gap

A historical approach seems appropriate in order to complement former analyses of the too obvious gap between science and the public. The standard view of science communication as
an attempt to bridge a gap has been subjected to radical criticisms over the past decades by sociologists. First, critical analyses of the traditional views and practices of science communication presented the gap as an ideological entity created by science popularizers in order to position themselves as mediators. In fact, they invented and reinforced the gap that they pretended to bridge. Rather than fighting against public ignorance, they deliberately disseminated an image of science that reinforced the scientific authority of the experts. The self-image of mediators as the “third-man” invested with the noble mission of bridging the social gap between “savants” and “ignorants” turned out to be a rhetorical strategy of self-legitimization. Moreover Ludwik Fleck’s view of a graduated hierarchy of initiates and many threads connecting the various grades between the esoteric and exoteric circles of any thought collective has been confirmed by sociological and linguistic approaches to science popularization. They tend to replace the traditional image of the gulf between scientists and the lay public with the view of a continuum of enunciation from the most esoteric article to lay public presentations. In addition, they confirm Fleck’s suggestion that the communication of ideas always results in a change of the content, and that each passage from one collective to another one creates a new meaning rather than simply transferring a stable message. Thus, the clear distinction between science production and science communication collapsed as a result of careful analyses of literary technologies in the validation and stabilization of scientific statements. In particular, in the actor-network framework developed by Bruno Latour, the gap is inevitable although it is not natural. The exclusion of common readers is no longer viewed as a downside of the technicalities of scientific literature. Rather, it is essential to the fabrication of hard facts.

All these criticisms played a crucial role in the emergence of a new and more realistic perspective both on science communication and science making. However, they are only concerned with a static notion of the gap, whereas the specificity of the contemporary references to a gap between science and the public are rather to a process of alienation. The dynamic notion of an increasing gap is closely related to the common assumption of the progress of science. When it is assumed that the advancement of science is a natural and necessary process that nothing—no human intervention—can stop, then nothing can prevent the increasing gulf between the professional scientists in charge of the production of knowledge and the public that consumes the products of knowledge.

It is important to clearly distinguish this modern notion of the gap as a process from the ancient notion of the gap between science and opinion. In fact, the distance between the learned and the rest is not a regrettable downside of the tremendous advancement of science, rather it is a key ingredient of the definition of science itself. Without entering into a scholarly analysis of the relationship between science and opinion in the works of Plato and Aristotle, it suffices to recall two famous anecdotes concerning one of the mythical founding fathers of science, Thales of Miletus (seventh century BC). Thales was already a mythical figure for Plato and Aristotle, who simply reported the legends told about him.

In the *Theatetus* (174a-b), Socrates reports how Thales was said to have fallen down a well while walking, oblivious to his surroundings and totally absorbed in his own thoughts. This accident provoked the laughter and mockery of the young Thracian servant girl who witnessed it. The anecdote shows that the image of the absent-minded scientist, as would later be illustrated in innumerable comic books, is as old as western science.

The scientist and the illiterate girls live in the city, walk in the same streets, breathe the same air, and yet they live in two separate worlds. They do not understand each other. The gap between them is ontological. This clear-cut distinction between *epistémê* and *doxa* was needed in order to avoid the threatening relativism of the Sophists who continuously questioned the validity of scientific knowledge by mixing up science and sensation or science and opinion.
And from Plato’s famous allegory of the cave, we know that only the philosopher-scientist obtains knowledge of the real things while the public is content with sensible appearances or copies of the originals. Thus, the notion of a gulf between two worlds causing radical misunderstanding between those who seek knowledge and those who conduct their daily business is as ancient as western science—it is primitive and archaic. The distance suggested by the ancient Greek philosophers is so radical and maximal that one cannot imagine how it could increase over time.

Rather, the philosophers suggested an organic division of labor between those who pursue theoretical knowledge and the practical knowledge acquired by citizens and servants in their daily practice. In fact, the distance does not simply result from the girls’ lack of knowledge but from the scientist’s own ignorance. In their effort to understand the cosmic order of the universe, scientists fail to understand the most ordinary phenomena and the ordinary things that are before them. Interestingly, Socrates suggested that the advancement of knowledge be at the cost of some oblivion. Ignorance and knowledge are not two separate states of mind or two different portions of mankind. Rather they are complementary attributes of the same person: “Those who seek to know what happens in the starry sky ignore what is happening right before them, at their feet.”

Thus, Socrates created an effect of symmetry. Far from being ignorant, the servants had their own knowledge. Neither Plato nor Aristotle ever suggested that opinion should be replaced by the knowledge of scientists (or philosophers—there was no difference between science and philosophy in those times). Socrates insisted that science was neither the unique nor even the best guide in practical matters. Citizens could live an honest and virtuous life without science, on the basis of right opinion (orthe-doxa). Far from disqualifying opinion, Plato and Aristotle both praised and recommended the culture of right opinion for the citizen. For practical matters and politics, opinion is more appropriate than epistêmê, especially when it is right opinion.

To sum up this flashback to the origins of western science, it is clear that the idea of a gap between scientists and the others is a necessary ingredient of our notion of science. However, it is also clear that this constituent distance does not automatically entail a disqualification of the public’s knowledge. By contrast the modern dynamic notion of an increasing gap suggests a view of the public as a passive mass of consumers of science information and more importantly of science-based technological items.

It is the emergence of this more recent notion of a process of alienation depriving the public of all positive qualification that this paper tries to analyze. For this purpose, two methodological premises are needed. First it is important that history of science should no longer be isolated from the history of the public’s attitude toward science. When the public is mentioned in historical accounts, it is most often to discuss the reception of scientific theories—Newton on the continent, for example, or Darwinism in France. The public has never been considered as a partner of scientific enterprise. Most historians of science do not even suspect that the notion of the public has its own history. It is also important to consider the past in its largest extent. Only in the longue durée can we understand the status and functions of the notion of the gulf between science and the public and the changing images of the public. First, I will reconsider the tradition of mundane science that flourished in the eighteenth century in the light of the emerging politic notion of public opinion. Then, I will argue that while science popularization developed in the nineteenth century, a new notion of the public as a mass of consumers was constructed. It prompted a division between science producers and science consumers but did not presuppose a gap between scientists and the public. Finally, I will argue that the modern notion of the increasing gap with its associated notion of ignorant public only emerged in the mid-twentieth century.
Indeed, it is impossible to give a full historical account of the joint evolution of sciences and the public. Rather, the ambition of this paper, focused on the French case, is simply to provide a number of conceptual tools that may be helpful to rethink the agenda of science communication by initiating a more symmetrical approach to the notions of science and public.

2. The Enlightened public opinion

The origin of science communication is often traced back to the early eighteenth century. In France, for example, Bernard Le Bovier de Fontenelle, the author of the Entretiens sur la pluralité des mondes is considered to be the founder of science popularization. It is certainly the case that the diffusion of scientific knowledge was already a prosperous genre in the eighteenth century. A number of popular books, including semi-galant conversations with a marchioness, helped to popularize Newtonianism, electricity, and chemistry. Diderot’s Encyclopédie sold thousands of copies in France and in a number of other European countries. The taste for science was cultivated in the aristocratic salons where the respective merits of the various systems of the world were discussed and debated. Experiments were performed in the elegant private cabinets of a small number of wealthy aristocrats, or in small physics laboratories equipped with electrical and chemical instruments. Thus, public interest in science was associated with amateur practices of science. Despite the existence of a strong academy of science in Paris with appointed full-time researchers, there was no clear-cut demarcation between amateurs and scientists. Amateurs considered themselves to be members of the republic of science, a large international community or network of people who investigated nature and reported their results to each other. They shared certain values, such as meritocracy, tolerance, and reason, and standards of conduct.

Second and more importantly, these enlightened amateurs helped promote public opinion as a political force, indeed as the only legitimate base in enlightened societies. Whether amateur or academic, the practices of science contributed to the emergence of the “public sphere” described by Jurgen Habermas as a new entity shaped through discourses and dialogues in the press, cafés, and salons. Both in the political sphere and in scientific milieu, a critical spirit based on reasoning was highly valued. To a certain extent the amateurs of science answered the famous injunction made by Immanuel Kant in What is the Enlightenment?: “Sapere aude,” meant that all individuals had to exercise their reason and judgement, to think by themselves, to form their own views and no longer rely on other’s expertise. “The public use of understanding” was both a cognitive and a political gesture. The public culture of science was an integral part in the movement of emancipation from all religious or political authority that was not based on reason. Thus, the prevailing notion of public opinion undoubtedly favored the public participation in the scientific endeavor. However such mundane practices increasingly raised tensions and conflicts between scientists and public opinion, which culminated in the decision to dissolve the Academy of Science during the French revolution together with failed attempts to promote a people science—a “science-sans-culottisée.”

3. The nineteenth century: the consuming masses

“Science is a sun: everybody must move closer to it for warmth and enlightenment,” according to Louis Figuier, one of the most prolific and successful scientific writers of his time, who expressed in this metaphor both a credo and a program. The assumption is that the sun shines for everyone not just for an elite or the happy few. Science had to be placed “within everyone’s reach.” The idea was that everybody had to be interested in science and so the program of
Numerous attempts were made during the course of the nineteenth century to achieve this goal. Hundreds of books, journals, and magazines endeavored to place science within everyone’s reach. It was a wide-ranging operation that mobilized all the existing means of distributing information: lectures, conferences, magazines, books, encyclopedias, exhibitions, museums, observatories, botanical and zoological gardens, cinema, radio and television. This multimedia communication rested on technological advances such as rotary systems that allowed the rapid growth of a cheap press in the nineteenth century. Among the journals and magazines that strove to spread science, some are still published today including The Scientific American, founded in 1845, and the British weekly Nature, founded in 1869. Science participated in development of a popular press. In French and British newspapers, scientific news moved into the daily columns along with the political, social, economic, and literary news. With the creation of the weekly scientific feuilletons, science became an integral part of ordinary life.

The presence of science in social life was increased considerably during the second half of the nineteenth century by the World Exhibitions, which attracted millions of visitors and brought together over a six-month period industrialists and workers, and experts and amateurs. Starting in 1851, with the exhibition at Crystal Palace in London, more than 25 international or universal exhibitions were held at regular intervals in the main cities of industrialized countries before 1914. Progress was invariably celebrated and technology was presented as being at the forefront of civilization. Technology occupied a prominent place in the huge machine galleries—ever bigger, ever higher—exemplified by the enormous steam engines and later by the fairies in the electrical palace at the 1900 Paris Exhibition. Science, as such, remained inconspicuous in the exhibitions themselves, but was omnipresent in the accompanying rhetorical discourse and was praised as a precondition for technological progress and prowess. To be sure, the World Exhibitions propagated no more than a bare minimum of knowledge, despite their professed educational mission. But they did convey striking images of science and technology, accompanied by impressions and feelings that contributed greatly to their penetration into society. The dynamics of a mass culture was reinforced by science museums, and dozens opened in the second half of the nineteenth century. All these monumental enterprises designed to spread science information among the public were accompanied by attempts to bring science into the private bourgeois sphere.

Mass consumption of science was encouraged at home—in private life—by the commercial success of popular science literature. From the small, cheap booklets to the large expensive dictionaries, a wide range of books and serial publications was sold to suit all tastes, classes, and economic conditions. The mass consumption of science in the nineteenth century was part of the global process of the emergence of mass consumerism. Science publishers used marketing strategies to expand their audience. One strategy was to adopt a certain modesty. Thus, most of the publications were modest, both in their intellectual ambitions and their prices. A periodical could be purchased for the price of a loaf of bread. The science publications were not, however, all cheap paperback volumes. A number of publishing houses started industrial production with luxurious hard-covered and richly illustrated volumes available at a modest price. By the end of the nineteenth century, popular science had become a lucrative business, managed by prosperous publishers such as Flammarion or Hachette in France, or MacMillan in the United Kingdom. The circulation of such books was obviously dependent on the spread of literacy into the lower classes and rural populations—i.e. on the development of education systems and the creation of public libraries in urban areas.
Nevertheless, literacy was only one precondition. An audience had to be created, aided by various campaigns aimed at raising public interest in the subject. One key strategy used by science publishers was to diversify their readership. The same volume could be published in slightly different versions and distributed in these different forms to manufacturers, farmers, gentlemen and clergymen, or to women and children.

A major concern for science publishers was to establish a base of regular customers. In contrast to textbooks, popular books have no fixed, captive market. The interest of the customers has to be continually stimulated and even re-created. One of the best ways to maintain a wide readership was to create collections of books like the Bibliothèque rose, published by Hachette in France, which issued hundreds of informative volumes for children, and widely circulated.

It should be noted, however, that the figures for the numbers of copies circulated do not provide reliable evidence for the real extent of the dissemination of science among the general public. There is some evidence that popular science books were considered ideal reading material, recommended for public libraries, as presents or as awards for meritorious schoolchildren. How many of them were actually read? We can only gather some hints concerning the answer to this question by looking at personal records or literature.

What was the underlying image of the public? The prevailing assumption was that scientific knowledge was useful and maybe even indispensable in everyday life. Science was presented as being practical, useful, amusing, recreational, popular, mundane and entertaining. Consequently the favorite subjects were practice-oriented, including natural science as well as agriculture, hunting, medicine, hygiene, rural economics and new technologies. However, at the turn of the century, astronomy, geology, electricity and moving pictures spread another image of science as a source of wonder and magic. Many other good reasons were put forward as justifications for launching new journals or magazines: combating obscurantism, satisfying the public’s curiosity and appetite for knowledge, fulfilling a universal need, keeping the public up-to-date with respect to the constant scientific progress, or informing citizens in order to enable them to exercise their rights. Epic or pragmatic, humanist or political, all these arguments were based on a central philosophical assumption about the continuity between science and common sense.

The continuity between science and common sense was, in fact, the basic postulate which underlay and even inspired most nineteenth-century popular enterprises. This credo was elaborated in Auguste Comte’s philosophy. Positive science, in contrast to metaphysics, emerged out of common sense. It was, according to Comte, no more than a continuation of our daily spontaneous activity of discovering regularities that allowed predictions. Since science was “a simple methodical extension of universal wisdom,” the distance between the scientific elite and the general public was a linguistic artifact due to the use of formal or technical languages. Therefore Comte criticized scientists for their abuse of esoteric languages. He equally criticized the attempts at making money with popular science. He vilified the “trafiquants de science,” or “vulgarisateurs” who transformed an educational project into a commercial enterprise. Many lecturers in popular astronomy, like Comte, carefully distinguished their own practices of popular science from a lower genre of vulgarization.

For a number of nineteenth-century science writers and lecturers, popular science was much more than simply the dissemination of science. Once educated, the public could play a political role in society. Comte, for example, claimed that proletarians would have to regulate the advancement of science. Using their rugged common sense they were expected to correct the scientists who were too much inclined to esotericism, thereby exercising continual control over and surveillance of the academic community. Popular science was also a central feature of all utopian socialist programs in the nineteenth century. Popular science was intended to
preserve a broad and Unitarian view of science while professional scientists became more and more specialized and narrow-minded. The public—women, workers, and others—would participate in the evolution of science as gatekeepers of the unity of knowledge, providing the orientation of science policy and ensuring its regulation.

A central ambiguity resulted from this rapid growth of popularization during the nineteenth-century. On the one hand, popular science becoming a profitable market commodity, one of the many mass produced items that developed in the late nineteenth century—at least in the more industrialized countries—so the public of science can be accurately characterized as consumers of popular science. The social division between scientists and the lay public brought about by the professionalization of scientific work through the course of the nineteenth century was reinforced and stabilized by the emergence of this category of “scientific consumers.” On the other hand, popular science was developed as an alternative practice to science proper. Making a distinction between knowledge producers and knowledge consumers was by no means a natural and unproblematic process. Indeed, there were controversies over the role of popular science periodicals, for example. Should they privilege popular practices of science or popular judgements on scientific controversies, or should they mirror the activity of academic scientists? There was no consensus in the scientific community over this question. While many scientists considered amateur practices as a step towards a republic of science or the promotion of a free science. Others, like Louis Pasteur, clearly ascribed science magazines the unique function of reporting on academic activities with precision and respect. In Britain, many magazines sought to encourage amateur scientific activities by inviting their readers to communicate scientific observations or technological inventions to others, sometimes organizing scientific activities. Botany that encouraged amateur practices especially blurred the emerging division between science producers and science consumers. Astronomy was another privileged niche for the lay practice of scientific investigation. In France, Camille Flammarion equipped an observatory near Paris, thanks to a public bestowal, which enabled amateur astronomers to compete with professional astronomers. In 1988 in Germany, Helmholtz and the Siemens Company contributed to the creation of the Berlin science center, Urania, where microscopes, telescopes, and a scientific theater were available to the general public. Thus, popular science and academic science gradually came to form two distinct but parallel networks. So intense was the activity of popular science writers and editors that the whole international network of professional scientists that was emerging through international conferences and academies was echoed, or doubled, by a network of popular science writers, popular observatories or botanical gardens, as well as popular magazines and publishers that exchanged printing plates and articles, compilations and translations, observations or specimens. In other words, in the late nineteenth century “popular science” did not necessarily mean “popularized science.”

4. The twentieth century: the ignorant masses

A quick glance at the renewed efforts of science communication after World War I suggests continuity with the nineteenth century. There was a boom of initiatives for disseminating science to the public-at-large through magazines, exhibitions, encyclopaedias, radio programs, and movies. Moreover, science communication was established as a public institution in a number of countries, with the creation of professional associations of science journalists. However, the impression of continuity and reinforcement is only superficial. It obscures a gradual but nevertheless decisive change in the status of the public for science.

The language bears the symptoms of this change of mentality. While we still use the phrases popular culture or popular music in the twentieth century, the term popular science
no longer refers to any specific practice or discourse of science. It is only used to refer to
the image of science as reflected by vehicles of pop culture such as advertisements, best-
selling novels or television, serials. In the English language, the nineteenth-century notion
of popular science has been replaced first by science popularization and later on by the more
neutral phrase science communication, while the more problematic and rather awkward term
“vulgarization” has prevailed in the French language. What is certain is that the notion of
a popular science as a science distinct from that of the professional scientists is no longer
acceptable. Any non-professional practice of science that is not shaped and constrained by
the current norms and regulations of the academic community is labeled a pseudo-science.
There is no alternative science. Science is unique. Thus, the world of knowledge is clearly
divided into two categories: that of the scientists, who hold the monopoly of true, valid
statements, and that of the rest, the numerous, anonymous, and amorphous mass forming the
public. These linguistic changes reflect a process of alteration in the public understanding
of science. The enlightened public of amateurs, a term that still retained a strong positive
connotation of connoisseurs in the eighteenth century, has been transformed into a mass of
gullible, irrational, and ignorant people in the twentieth century. Whereas the emergence of
the mass communication of science in the nineteenth century rested on the assumption that the
gap between scientists and the public was accidental rather than essential and did not disqualify
the public from knowledge, its twentieth-century heir, science communication, rests on the
assumption that the public has no access to true and valid statements. This new credo was
clearly expressed by the French philosopher of science, Gaston Bachelard in 1938:

Science, in its need to achieve completeness, as well as in its principles, is totally
opposed to opinion. If it happens that science confirms an opinion concerning a
specific point, then this is for reasons different from those on which the opinion is
grounded, so that, in principle, opinion is always wrong. Opinion is the outcome of
bad thinking, or rather of no real thought: it expresses a need for knowledge. (...) 
Nothing can be based upon opinion. It has to be destroyed.35

For our present purposes, it is worthwhile emphasizing three aspects of this powerful
condemnation of opinion.

1. In Bachelard’s polemical view of science, as developed in The Philosophy of No, opinion
is more than just an uncertain and inferior kind of knowledge lacking in solid arguments.
It is counter-knowledge based on prejudices, immediate and premature answers, and naive
realism. Therefore, it is a positive obstacle that needs to be overthrown in order to acquire
a scientific mode of thought.

2. Fighting against opinion is both an intellectual and an ethical enterprise. It involves the
renunciation of the many interests at stake in opinion whether they are practical, economic,
or individual interests. As Michel Serres has pointed out, Bachelard’s list of epistemic
obstacles to the Formation de l’esprit scientifique is very similar to a religious ethic, a
cathartic process for purifying the soul, requiring the apprentice scientist to avoid most of
the seven capital sins.36

3. Fighting against opinion is not only an intellectual and moral attitude, it is also a social
attitude. Like traditional priests, scientists should renounce the mundane life, with all its
pleasures and seductions. Scientists should form a community because, for Bachelard,
science is necessarily a collective investigation, but they still remain apart from average
men, and distinguish themselves from l’homme de la rue. They do not belong to the
same universe, and do not share the same system of values. More precisely, connections
between the scientific city and the rest of the city are permitted only in one direction, from
the scientists towards the public. The scientists can teach and train public opinion but public opinion has nothing to teach the scientists.

So there is no adequate way of thinking apart from scientific reasoning. Once the public’s judgement is completely disqualified, what follows is a polarization of the social distribution of knowledge within modern societies. Such a phenomenon can be described from two different perspectives, the former being by far the most common view today. When considered from the standpoint of the scientists, this phenomenon is described as a natural consequence of the necessary advances in science and technology, leading inevitably to the so-called increasing gap between science and the public. However, this is only the perspective as viewed from one side. Viewed from the standpoint of the public, this process could better be described as a gradual deprivation of knowledge affecting the large majority of citizens. Public knowledge is denied all relevance while a minority of scientists holds the monopoly of legitimate knowledge.

How are we to consider these two alternative descriptions of one and the same situation? Are they like those famous dual images of the duck and the rabbit or the old and the young woman that psychologists use to illustrate the role of Gestalt in sense perception? Or, do the scientists/public perspectives offer an illustration of Niels Bohr’s specific notion of complementarity between two alternative and mutually exclusive descriptions of a phenomenon, both of them being equally valid although incompatible?37

At this point, a contextualization of these views may prove fruitful. Let us try first to identify the context that prompted Bachelard’s strong condemnation of opinion. Relying on French sources, I do not intend to promote France as a microcosm reflecting the entire world situation! Rather than considering it as a representative sample, I would like to present the French case as a specific configuration exemplifying the intricate inter-relations of scientific, cultural, and political circumstances.

Bachelard, who was himself a physics teacher, developed his epistemology on the basis of examples taken from non-Euclidean geometry, relativity theory, and quantum mechanics. The new scientific spirit generated by the new physics required a radical break with common-sense views of the world. Bachelard’s famous split echoed and amplified the message delivered by an intense campaign of diffusion launched by physicists during the interwar period.38 After Albert Einstein’s visit in 1922, a number of active scientists such as Charles Nordmann, Paul Langevin, Louis de Broglie, and Marcel Boll, among others, made various attempts at popularizing the new physics through public conferences or popular publications. They succeeded in spreading the new ideas among intellectuals to such an extent that relativity theory and quantum mechanics were better known to French historians and philosophers than by professional physicists. Thus, the new physics became part of Parisian intellectual life. In retrospect, it is easy for us to recognize that in addressing the educated public, the French physicists were indirectly trying to convince their colleagues of the validity of the new physics. However, it is remarkable that this instrumentalization of the public helped bridge the gap between the two cultures that C. P. Snow deplored in his famous pamphlet written in the ’50s, some 20 years later. Ironically, the problem emerged long after its solution. More ironically and most importantly, this alliance between humanities and physics was made at the cost of a radical break with common sense. The main message spread around was that relativity theory and quantum mechanics overthrew our familiar notions of space and time, as well as the classical notions of causality and determinism. Formalism was no longer just a convenient language for expressing reality. It was the only valid language and any translation into ordinary language was necessarily inadequate.

This message led René Sudre, the author of the article “Vulgarisation” in the Encyclopédie française, a monumental publication edited by the historian Lucien Febvre, to distinguish
three stages in the evolution of the relationship between science and the public. During the first stage, epitomized by Fontenelle, scientists and the public differed only by their style of argumentation. Later, in the nineteenth century, with the formalization and matematization of science, the difference in style became a linguistic one: hence, the need for a mediator or translator. During the twentieth century, scientists and ordinary people live in two different worlds. This naturalization of the increasing gap was based on a very particular view of science. A selective attention to the new physics allowed Sudre, along with other science writers, to consider that the few theories that challenged the traditional foundations of science were the model for all scientific thinking. This tendency to reduce science to a physicist’s model played a key role in the construction of the dogma of the increasing gap.

Moreover, Sudre’s three-stage law directly contradicted Comte’s more famous version. Not only is the gap considered to increase over time but its nature changes. If science and the public exist in two separate worlds, the incommunicability turns out to be something like incommensurability. The alleged ontological divorce between science and the public also resulted in a gradual change in the public image of science. Considered separate and far-removed, science came to occupy the place of the sacred in our culture. In the contemporary anthropological works of Roger Caillois and Mircea Eliade, the sacred was defined precisely by its separation from the profane, from the sphere of ordinary life. Because it is never under control, the sacred is both an object of veneration and an object of fear and terror.

This sacramentalism of science, with the ambivalent feelings it generated, became more visible in the context of the cold war. French popular magazines commenting on Sputnik inevitably referred to the increasing gulf and encouraged an attitude of awe among their readers. For example, in 1958, an editorial of the French magazine *Science & Vie* entitled “Si c’était vrai?” started like a fictional account: Soviet submarines invade the port of New York and soldiers of the Red Army take over the US Congress. At this point the editorialist stopped the narrative to stress that although incredible this scenario could become reality: “Science has made such tremendous advances that the opinion of the wise people no longer differs from that of the naive. (...) So great has the gap between the scientific elite and the mass become that we may fall back into the dark age of credulity (or skepticism, which would be no better) similar to the darkness generated by the great upheavals of 1000.” The image of the gap was used to suggest a secret and all-powerful military–scientific complex running out of control. This editorial stressed one remarkable and major consequence of the increasing gulf: the quasi-supernatural power of science, which challenged the most reasonable predictions, engendering a state of confusion in public opinion.

This alteration of public judgement is an important feature of the mythology of the increasing gulf. To us, it certainly looks like a tactical device used by popular writers or journalists to present themselves as the judges and spiritual guides of public opinion. For their readers, however, it meant that the ideal of enlightened opinion had become obsolete. Kant’s famous injunction “Sapere aude,” think by yourself, never rely on anyone else’s opinion, but cultivate your own faculty of judgement, had become impossible. The public was no longer responsible for either knowing or not knowing. Public opinion would necessarily be inadequate when faced with scientific and technological choices.

Thus, the twentieth-century popularization of science is by no means the development of the genre that had emerged in the previous centuries. Rather, it has undermined two major preconceptions that had inspired and legitimized the expansion of science communication since the nineteenth century. First, the eighteenth-century view that all human beings are endowed with a faculty of judgement, which they have to develop in order to become adults. And second, the view that science is rooted in common sense and is nothing other than an elaborate form of public reasoning.
However, rather than helping disentangle the duality between two alternative descriptions of the same situation mentioned above, the historical perspective shows a remarkable solidarity between them. The notion of an increasing gap between science and the public is heavily dependent upon twentieth-century physics. It emerged in the context of relativity and quantum physics and became the dogma of modernity, in particular in the guise of nuclear physics during the cold war, when research policies were no longer under the control of public opinion. The message of a radical break delivered by science mediators gradually disqualified public opinion, and at the same time justified its decreasing influence on science policy. While the epistemology of rupture has been mainly inspired by physics, at the same time it has increased the reductional tendencies of identifying all the sciences with physics. Hence, the popular image of scientists as super-heroes living outside our familiar world in a separate sphere far removed from ordinary life.42

If the correlation here suggested between the domination of physics and the conviction that there is a radical break between science and the public is true, then it is possible to envision the collapse of this myth. Hopefully, the current decline of the prestige of physics that has been noted in various countries over the past 10 years, and the consequent increase of the prestige of biological and environmental sciences could bring about a deep transformation in the relations between science and the public. Indeed, a number of movements have emerged recently that testify to the increasing concern of citizens in the pursuit of scientific and technological research.43 Such movements as AIDS associations in the US, the consensus groups in Northern Europe, and the Swiss debate on science policy issues such as the pursuit of research on genetically modified organisms, are reviving the enlightenment notion of public opinion, of responsible citizens willing to fully exercise their own judgement on scientific and technological issues.

From this rapid voyage through the centuries what can be concluded? Clearly we are faced with a paradox. The notion of a gap between scientists and the public is archaic, essential, and extremely recent and relative to a specific conjunction of circumstances. However the paradox is only apparent since the historical approach also helps disentangle various meanings of the notion of public that are like overlapping layers or strata. The ancient epistemic notion of opinion (doxa) forged in opposition to science (epistêmê) helped stabilize the definition of science and the social status of scientists within the Greek society. The Enlightenment political notion of public opinion, by contrast, blurred the distinction between science and the public by encouraging everyone to the practice of science. The nineteenth century more sociologic notion of the public as a mass of consumers encouraged the distinction between science producers and science consumers. Yet, it maintained continuity between them. It is only in the twentieth century that a depreciative image of the public emerged. Never before had the public been disqualified and deprived of its faculty of judgement to such an extent. Contrary to the standard view, scientism is more characteristic of the twentieth century than of the nineteenth-century.

How are we to cope with such a complex entity as the public? Without taking instruction from the description of the past, I would suggest that instead of trying to reduce the notion of the public to one of its dimensions, we ought to recover all its dimensions. The notion of a gulf is so archaic, so full of meaning and over-determined that we need to reconsider all its facets before introducing a policy to heal the “social fracture.” If we recall that the rhetoric of the increasing gulf emerged from a very narrow view of science inspired chiefly by nuclear physics, and that it sanctioned science and consequently disqualified opinion, we may not want to take the repeated complaints about the low level of public understanding of science so seriously.

Recent movements of citizen science have already revived the enlightenment notion of
public opinion. It is time to also revive the ancient notion of doxa as a specific popular variety of knowledge that is more relevant than science in the sphere of political decisions because we never fully grasp the consequences of our decisions. We may even doubt that it is necessary to bridge the gap. Like the Thracian girls, we might just as well assume that scientists pursue their own interests, that they address—and often successfully solve—their own problems but that it does not automatically mean they provide answers to the questions posed by other citizens. We may finally wonder whether it would not be more appropriate to develop programs aimed at educating the citizens in orthe-doxa, cultivating their ability to form and keep a right opinion about issues of public concern.

Acknowledgments

Preliminary versions of this paper have been read and discussed at a conference on “Desiderata der neueren wissenschaftgeschichte” at the Internationales Forschungszentrum Kulturwissenschaften in Vienna (June 1998) and at a symposium “Writing science, selling science” of the Collegium Helveticum in Zurich, May 1999. Many thanks to all participants who commented on this paper, especially to Professor U. Felt and Professor H. Nowotny. I am also grateful to J. Simon for his revision of the manuscript and helpful suggestions. The argument presented in this paper has been further developed in B. Bensaude-Vincent, L’opinion publique et la science. A chacun son ignorance (Paris, éditions Synthélabo, 2000).

References

2 One exceptional occasion where the notion of gap is openly debated is the remarkable collection of articles gathered in “Launch Perspective,” Public Understanding of Science 1 (1992).

8 See, for example, Yves Jeanneret, Ecrire la science, Formes et enjeux de la vulgarisation (Paris: PUF, 1994).

9 See B. Latour, Science in Action, chapter 1, especially the conclusion: “Although it sounds counter-intuitive at first, the more technical and specialized a literature is, the more social it becomes, since the number of associations necessary to drive readers out and force them into accepting a claim as a fact increase (...) The distinction between the technical literature and the rest is not a natural boundary; it is a border created by the disproportionate amount of linkages, resources and allies locally available. This literature is so hard to read and analyze not because it escapes from all normal social links, but because it is more social than so-called normal social ties,” (Cambridge: Open University Press, 1987): 62.

10 Plato, Republic VII, 515b–518c.

11 Opinion or doxa is not synonym of ignorance, rather in Republic VI it was defined as an intermediate between science and ignorance.

12 See, for example, Plato, Menu, 97a–97d.

13 Symmetrically, however, it should be noticed that Jürgen Habermas’s description of the emergence of the notion of “public sphere” does not take into account the role of scientists (J. Habermas, The Structural Transformation of the Public Sphere, translation by Thomas Burger with Frederick Lawrence, Cambridge, MA, 1989).

14 For example, M. F. Mortureux, La formation et le fonctionnement d’un discours de vulgarisation scientifique au XVIIIe siècle à travers l’œuvre de Fontenelle (Paris: Thèse de l’Université de Paris VIII, 1983).

15 One illustration is the best-seller by F. Algarotti, Il Newtonianismo per le Dame, Naples, 1735, immediately translated into French (1735), then in English as Sir Isaac Newton explained “for the use of the ladies in six dialogues on light and colours” (1739) and later on in German (Berlin, 1752).


23 The invention of the term scientist by Whewell in the 1830s instead of the traditional denomination “philosopher,” reflects this integration and at the same time shows that it was a slow and gradual process since, as pointed out by an anonymous referee of this paper, the term was scarcely used until the early twentieth century.


25 After the South Kensington Museum was created in 1853, some 100 museums were created in Great Britain in


29 A. Comte, *Discours sur l’esprit positif* 1844, paragraph 34 (Paris: Vrin, 1995), 127–127; A similar assumption can be found in T. H. Huxley’s definition of science as nothing more than organized common sense. Such representations were however challenged by alternative claims that common sense was inadequate and misleading towards the end of the century; A. Comte, *Cours de philosophie positive* 34e Leçon (Paris: Hermann 1975), 546.


Author

Bernadette Bensaude-Vincent is in the Département de philosophie at the Université Paris X, 200 Avenue de la république 92001 Nanterre, France.