



Historical Article

## Communicating Science: a Modern Event

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**Abstract.** Science is by its very nature an intersubjective, public, collaborative and democratic (at least in principle) enterprise. The modern scholar of nature, in fact, cannot but communicate first of all to his/her colleagues the results of his/her research, since, in the final analysis, science is a socially shared and socially validated corpus of knowledge. The results of research must therefore be made public but non only among the specialists. The modern way of communicating science has triggered a progressively accelerating circulation of documents (rather than researchers), reversing a more than secular trend in which scholars reached the places where knowledge was deposited and archived. The modern databases, that host books, newspaper and periodicals like actual libraries and are accessible online, represent the last expression of this inverted mobility between documents and consultants.

**Keywords:** communication, modern science, ethics of research, progress, academies, scientific press, scientific entertainment.

The emphasis that is generally put in modern science on the problem of communication has a very profound *raison d'être*: compared to many other forms of knowledge, science is by its very nature an intersubjective, public, collaborative and democratic (at least in principle) enterprise. The modern scholar of nature, in fact, cannot but communicate first of all to his colleagues the results of his research, since, in the final analysis, science is a socially shared and socially validated corpus of knowledge. Only the work which is actually understood by other scientists and used *hic et nunc* counts for the progress of science. The results of research must therefore be made public. Whatever scientists think or say individually, their findings cannot be considered as belonging to scientific knowledge until they have been reported and recorded on a permanent basis.

This imperative has been (and is) often motivated as a moral obligation; as a service rendered to humanity in general, but it has a foundation in the very structure of the functioning of modern science, which has been born and developed since the Late Renaissance in opposition to an elitist tradition of knowledge and its transmission. Within this tradition, the language – often allegorical, metaphorical and analogical – served rather to conceal the contents of knowledge reached from the public of the uninitiated than to reveal them, in order to delimit its acquisition to restricted and selected cir-

cles of interlocutors, to the 'elected', precisely. The very idea of progress, which, as is well known, is strongly linked to the beginnings and developments of modern science, since it implies a transgenerational relationship, refers to the possibility of communicating over time that only appropriate language can allow, which must use concrete means capable of making such transmission possible. But this implies in advance that the very idea of translating and transmitting one's own thought in written form and accessible to most people is considered positive and valued.

After the first phase of the correspondence in terms of private contacts, even coordinated as in the case of Marin Mersenne and its "*cenacolo*" of the so called Academia Parisiensis at the beginning of seventeenth century, from the sixteenth century the scientific communication developed through networks of intellectual and curious individuals. These collectives were initially unformal, like the Gresham College, the Bureau d'adresses, l'Académie de Montmor and so on, but they were soon (1657-1666) replaced by real scientific Academies as the Accademia dei Lincei, the Académie Royale des Sciences, the Royal Society of London and all the other ones that were progressively constituted between '700 and today in Europe, North America and the rest of the world.

These new institutions – either spontaneous or under the patronage of erudite men – proliferated in the Modern Era, not only in the scientific fields, but also in the literary and artistic ones.

Besides the statutes that regulated the internal life and the admissions, some academies established their own press where papers discussed in specific sessions or sent by single scientists could be periodically printed. Academic proceedings were not the only way of publication; there were also books and an increasing number of journals and magazines, confirming that press played a fundamental role in the development of science and cultural dissemination.

Obviously, the transmission of memory in a long-term perspective needs a supporting material which is able to guarantee the circulation of knowledge from past to future. In this case the support must ensure almost unlimited reproducibility of the document, in order to make the necessary material available - cheaply and easily - for all those engaged in research activities or curious about the outcomes. The modern way of communicating science, therefore, has triggered a progressively accelerating circulation of documents (rather than researchers), reversing a more than secular trend in which scholars reached the places where knowledge was deposited and archived.

The modern databases, that host books, newspaper and periodicals like actual libraries and are accessible online, represent the last expression of this inverted mobility between documents and consultants. But, more important, they allow a relevant shortening of the time needed for sharing knowledge. Since the birth of the first Academies, scientific communication has been substantially institutional, anticipating the production of knowledges, that remained a personal and private activity, secondary to that one by which researchers got the means for their subsistence till the end of 19th century.

But writing in itself is not enough: the style must be clear and able to make the contents of the work comprehensible. To many "moderns", writing in an obscure way was equivalent not to write at all! The use of a written language which is understandable by the largest number of people is fundamental to allow the comprehension of a text. This need had been satisfied for many centuries by the use of Latin language.

For this reason, intellectuals and thinkers faced a contradiction between the universal comprehension of science versus the more democratic access to it by the use of local and national idioms which are more easily understood by citizens.

The modern science greatly contributed (albeit differently from the humanistic disciplines) to the crisis of Latin as universal language. This crisis originated from social, political and religious causes, which are deeply intertwined; thus, it is very difficult to analyse them separately. The success of National languages can be ascribed to the increasing interest in Science by common citizens from the emerging social classes. Knowledge was no longer a privilege of erudite people and nobility: Science was considered "useful" and lots of people looked at it as a mean of social growth.

For example, in the introduction to the Italian edition of the "*Cours de Chymie*" by Nicolas Lèmery (1675), it was possible to read that barbers and apothecaries would have considered this treatise so useful as to consult it with the same frequency as the priests read their breviaries. In this context it is also worth mentioning Galileo Galilei's works, that represent one of the most excellent expression of the Italian language of 17<sup>th</sup> century, able to maintain its virtuosity till today.

Between the end of 17<sup>th</sup> century and the beginning of the 18<sup>th</sup> century an ever-widening "public sphere" of science and technology was established outside academies, and scientific experimentation became a common practice in the institutions dedicated to teaching. These labs became usual rendezvous for people with different backgrounds and culture, and hosted discussions about the nature of philosophy, new techniques and discoveries.

A particularly rich audience meet in anomalous places like coffee rooms, hotels, guest houses, especially in England in the period '700-'800. Science became a very popular subject for public initiatives: international speakers started moving across European countries showing instruments, experiments and practical demonstrations during their conferences. Successively the first international exhibitions were established; here science, technology and industry were celebrated all together as the three main aspects of the same reality and recognized as the key actors for the economic development and the improvement of the social life quality. An explicative, albeit overlooked episode of the capillary penetration of science into society is the diffusion of agricultural education in rural areas (agriculture represented the main economic activity until the end of 20<sup>th</sup> century). The nobility, especially in France, Germany and England, was totally fascinated by this new tendency, producing a lot of informative printed material and giving life to a true propaganda in favour of science applied to agriculture, as shown in many literary works of that time.

Science became also a source of playful and 'wonderful' entertainment: initially restricted to the aristocratic and bourgeois elites, it progressively propagates to all social classes. This was the origin of the *physique amusante*, a definition given by the French chemist Jean-Sébastien-Eugène Julia de Fontenelle (1790-1842) in his divulgation work *Manuel de physique amusante*, which was published in Paris in 1826.

This book is an example of a particular literary genre with the explicit popular aim of entertaining and amusing. However, in this kind of works there was a tendency to illustrate a certain law or principle behind some surprising phenomenon rather than demonstrating or explaining the causes, making these presentations engaging for the general public.

Between the 18<sup>th</sup> and 19<sup>th</sup> centuries in the most enlightened courts, as well as in noble houses, real scientific, educational or entertainment evenings took place, and the protagonist of the event was the most varied scientific instrumentation: electrostatic, mechanical, magnetic and electromagnetic, or even chemical and pneumatic. During these soirees the so-called '*electrifying physicists*' showed thrilling experiments with the '*electric fire*' (or '*electric virtue*'), which was considered by the new natural philosophers – as well as by actors, barkers and charlatans – the fluid responsible for the most varied phenomena, and capable of great and wonderful games, especially since it was discovered "that ladies generally electrify more easily than men and young women better than the old ones". This '*fire*' was also considered by some doctors (professional and not) as a vital

fluid, and a possible source of new and extraordinary therapeutic methods, like a sort of universal panacea. Electrical phenomena were particularly suitable for the theatricalisation of science, a very popular trend since the beginning of 18<sup>th</sup> century, especially in Great Britain. But scientific divulgation, even in an 'entertaining' or accessible way, did not involve only minor characters: the greatest disseminator of Newton's ideas in France was Voltaire with his philosophical pamphlets, or Jean d'Alembert in the pages of the *Encyclopédie*.

The salon of Emilie du Chatelet (1706-1749), a scientist and philosopher in the circle of Voltaire, at the castle of Cirey, was a center of divulgation of Newtonianism in the European continent. Regarding chemistry, Denis Diderot (1713-1784) was brilliant propagandist, together with Paul-Henry Thiry d'Holbach (1723-1789), who, in the mid-eighteenth century, translated into French (i.e. the language of science of the time) the works of the physician and chemist Georg Ernst Stahl (1660-1734), the founder of the phlogiston theory. Very few works are capable of explaining to a wide audience the theory of chemical affinity: excellent examples are the first chapters of Wolfgang Goethe's *Elective Affinities* (1809) (1749-1832) or, nowadays, Primo Levi's *Periodic System* (1919-1987). The broadening of the 'audience' interested in science reached both young gentlemen and – exceptionally – women: in particular works explicitly dedicated to women were composed, usually in the form of a salon or gallant dialogues, which gave life to a specific literary genre.

Some examples of these writings 'for ladies' were the *Entretiens sur la pluralité des mondes* (1686) by Bernard le Bovier de Fontenelle (1657-1757) who had numerous translations into Italian (1711, 1744, 1765, 1831, etc.), followed in Italy by the works *Il newtonianismo per le dame, ovvero dialoghi sopra la luce, i colori, e l'attrazione* (1737) by the Venetian polygraph Francesco Algarotti (1712-1774) and *La chimica per le donne* (1796) by the Jacobin Giuseppe Compagnoni (1754-1833). Many newly formed institutions, such as the Royal Institution (1799) in London, directed by the chemist Humphry Davy (1778-1829) and then by the physicist and chemist Michel Faraday (1791-1867), organized popular conferences on scientific subjects in the nineteenth century. These symposia became very popular, exciting events, just as concerts and theatrical performances (the *Christmas lectures*, inaugurated by Faraday in 1826, were dedicated to young people).

The current return of the *amusante* way of science spectacularization for the general public, through websites, television and radio broadcasts, magazines, science festivals, interactive science centers, 'science cafes',

'scientific theatre', and so on, have very prestigious precedents, in an era of great enthusiasm for a new form of knowledge which has proved to be the foundation of our current civilization.

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