

Europe of knowledge (seventeenth–eighteenth century) (The)

Letters, sciences, and the Enlightenment

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Abstract

In Europe, the seventeenth and eighteenth centuries saw a substantial rise in science and knowledge, which has long been referred to as a “scientific revolution.” This movement was more diverse and varied: it involved actors other than just men of science, and mobilized not just states and learned circles, but also artists, artisans, and engineers. Its public also expanded and grew better informed thanks to the circulation of printed matter. The Republic of Letters—broadened by the increase in correspondence, the rise of the press, and advances in translation—contributed to this movement, which largely surpassed the means of control and censorship available to states. With the broadening of horizons brought about by new explorations as well as new colonial and commercial empires, the theater of science and the thirst Europeans had for knowledge became truly universal. This renewed relation to knowledge and the world made powerful contributions to the forging of modern European identity.

Article

While the expression a “Europe of knowledge” may seem imprecise, it nevertheless encapsulates recent reformulations in the history of knowledge and science during the early modern times. It is indeed a vast undertaking to retrace the discoveries, practices, and social events produced by and in connection with the lettered, scholarly, and scientific circles of the seventeenth and eighteenth centuries.

This moment of ferment in knowledge has long been recounted as a triumphant odyssey, with its accepted pantheon of figures (the “scientist”), institutions (academies), practices (experiments), and locations (the laboratory). It literally dramatizes how modern sciences were constituted, and then gradually freed of the practices and knowledge from a preceding “pre-scientific” age. This narrative is based on the idea of a “scientific revolution” that was initiated during the seventeenth century. Both sparked and served by progress in instruments—the invention of the telescope or the steam engine—it enabled the constitution of independent scientific disciplines, in addition to the establishment of the protocols and institutions of modern science. In this way the sciences “left” the sphere of classical philosophy and “entered” modernity, a modernity that concerned Europe alone.

“Scientific revolution?”

Sketched out by Fontenelle (1657-1757) in the early eighteenth century, the narrative of the scientific revolution took hold at the end of the Enlightenment and especially during the nineteenth century, before being radically challenged starting in the 1980s. Historians have deeply rethought the issues, categories, and even the geography of the processes, places, and actors involved in the production of knowledge and science during the second half of the early modern era. In breaking with the earlier genealogical presentation of the history of science, they resituated science at the heart of societies.

The classical conception of a science that developed autonomously in isolation gave way to a reflection surrounding the actors of science and their relations with the rest of society. Instead of the traditional distinction between the theoretical sciences and practical knowledge, there were now explorations on how society and scientists defined and theorized what science, its subjects, and methods should be. Instead of a simple history of scientific institutions (hierarchical academies and scholarly circles), the behavior of the different actors of science was studied through the prism of anthropology and sociology. Returning to the networks, locations, and discourses of science allowed for thoroughly revisiting the geography of the Europe of knowledge. Conventional hierarchies—opposing “centers” of knowledge production (Paris, London, etc.) and more or less distant and passive “peripheries” on the scale of states, the continent, and the world—were relativized as a result.

Similarly, the history of the “sciences” was broadened to the wider domain of “knowledge,” notably in order to integrate the history of technology. Theory and practice are now seen as a larger whole combining knowledge of conception and organization with procedures and objects, both scientific and technical in nature. Equations teamed with applied experiments, while instrument production workshops became the antechamber for the laboratory. Historians now take a global approach in their exploration of scientists, laboratory assistants, and even the artisans who built the tools of science, who together formed a community contributing to the development of scientific empiricism. While the traditional perspective of the history of science long focused on scientific ideas, methods, and reasoning, historians today emphasize the important role played by the exchange of knowledge and know-how in sustaining this community, from the scientist to the artisan, and the laboratory to the workshop or the arsenal.

Beyond the conventional figure of the solitary genius, the history of science is now interested in the intermediary spaces for the exchange of knowledge and practices. These mixed locations were less isolated, and frequented by a long-neglected population. During the period that saw the triumph of the vacuum pump, telescope, and electric battery, the development of the very tools of scientific practice was the fruit of a dialogue between theory and practice. The influence of this dialogue extended as far as the conducting of scientific demonstrations. Scientific practice thus saw the

establishment of observation and experience, and of the description and modelization of protocols. Ever more normative, these uses were presented in treatises, demonstrations, and diagrams meant to ensure the legitimacy of the experimenters within the community formed by men of science, as well as authorities and societies. Far from being the exclusive affair of a few heroes secluded in their study, the definition of science with a capital “S” was a matter of social reception. The second modernity was in now way the triumph of scientific and experimental truth over error. The century of Isaac Newton (1643-1727) was also that of pseudo-scientific theories, such as animal magnetism, which were all the rage at the end of the Ancien Régime. The discoverer of gravity himself—just like Galileo (1564-1642) and Johannes Kepler (1571-1630) before him—was an enthusiast of astrology. By reflecting on what the public considered to be relevant to the domain of science, new actors, stages, and motivations have emerged. This led, for example, to the discovery of economic considerations and an unsuspected market logic in connection with the organization of craft guilds and clientele. For example, at the end of the Ancien Régime, the laboratory of Antoine Lavoisier (1743-1794) at l’Arsenal de Paris brought together eminent scientific figures, suppliers of products and materials for experiments, and skilled laborers and artisans who could produce reliable instruments, in short a series of trades associated with a vast economic network. One can see how the arts and sciences transformed into social practices and large-scale cultural, political, and social issues.

A small community

The imposing expression a “Europe of knowledge” cannot obscure more modest realities. The continent underwent profound demographic, economic, and social transformations, with a population rise from 120 to 200 million inhabitants between 1700 and 1800 (20% of the global population). For all that, the rate of overall urbanization barely reached 20% (50% in Holland, 35% in Great Britain, 20% in France), with the number of major cities (100,000 inhabitants or more) increasing from barely 10 to 17. While London, Paris and Amsterdam were genuine centers of intellectual and artistic influence, less than a half dozen capitals possessed all of the institutions of the arts and sciences: academies, university, learned societies, observatories, salons, etc. This already varied canvas is compounded by literacy rates that remained low. Half of the British population and 40% of the French population generally appear to have been literate in the late eighteenth century, although the data for the rest of the continent shows major inequalities. Northern Europe was more literate than the south, cities more so than the countryside, and men more than women.

The actors and public of the arts and sciences subsequently represented only a tiny minority of populations. The ideals of the education of humanity and the circulation of knowledge supported by John Locke (1632-1704) or Jean-Jacques Rousseau (1712-1778) were yet to be fulfilled. The society of rational and enlightened individuals aspired to by the Enlightenment and revived by the Revolution remained a distant horizon.

In this religiously and politically divided continent, the model of the authoritarian monarchy took hold as the norm. Only a few oligarchical republics (the Netherlands, Venice, Genoa, etc.) moved in a different direction, in addition to Great Britain, where the powers of Parliament tempered the omnipotence of the sovereign. Given this predominant political, social, and cultural framework, the spaces, means, and methods for the expression and exchange of ideas remained restricted. Censorship was still a reality in the life of the mind and the sciences. Spinoza (1632-1677) was censored in Holland, Galileo in Italy, Henry Fielding (1707-1754) in England, and the *Encyclopédie* in France (in 1752). This censorship was nevertheless circumvented by a network of secret publications on a continental scale, in which the Netherlands and Switzerland were seen as relative refuges.

The model of princely or state patronage remained broadly dominant. From the patron prince to the academies of the absolute monarchy *à la française*, protection from a powerful source was a necessity. It created a context with which artists, men of letters, and scientists had to skillfully contend. They had to navigate between measured provocation (which sparked talk of oneself) and well understood conformism, which opened the doors of courts with rigid and constraining practices, state institutions of knowledge, and literary salons. For instance, Fontenelle and Condorcet were able to personify the social and moral order of academies as well as freedom of manner and mind. Emerging from the institutionalized protection of the arts and letters by the princes and patrons of the Italian Renaissance—let us recall the Duke of Milan acting as patron to Leonardo da Vinci—academies became the home of European experimental science beginning in the seventeenth century. The highly hierarchical and controlled Paris Academy of Sciences (founded in 1666), as well as the more liberal Royal Society of London (1662), served as models that were replicated many times over across the continent. In the late eighteenth century, nearly eighty of these institutions connected the continent, with nearly 15,000 members, associates, and correspondents. Despite obvious disparities in status and prestige, they formed a community that powerfully affirmed shared sociabilities and institutional practices, in addition to a common scientific ethic. Correspondence, the publication of scholarly journals, and even eulogies contributed to this affirmation. However, behind the ethic of exchange, academic circles also saw obstacles to the circulation of knowledge, connected to the conventional hierarchies between institutions, as well as the implementation of genuine economic competition for discoveries. The rise of various scholarly societies (local academies, agricultural societies, applied arts societies) on the margins of major institutional and scientific networks in the late eighteenth century bears witness to these limits of the official academic world.

Sciences and letters

Thus the hopes of the English philosopher Francis Bacon (1561-1626) to establish the empire of humanity over the universe through the rise of knowledge were implemented by a highly multifaceted framework. This disenchantment of the world through empirical science sometimes met with authentic reservations, such as those of “conservative members of the Enlightenment,” who were

highly attached to the authority of the state and the magisterium of the Church. Newton, who was a symbol of this budding experimental age and new physical-mathematical perception of the world, dominated the field of European sciences at the time. The classification of nature with Carl Linnaeus (1707-1778), of chemical elements with Antoine Lavoisier (1743-1794), and the descriptions of the animal kingdom by Georges Buffon (1707-1778) in the late eighteenth century helped create the idea of a human order of the universe. Physics, chemistry, and biology progressed rapidly in proportion to advances to scientific instruments. The era of engineers and inventors had already begun, as the steam engine by Watt (1763) and Cugnot (1770), the lightning rod by Dalibard (1752), and the aerostat by the Montgolfier brothers (1782) flourished in a Northwestern Europe marked by the start of the Industrial Revolution.

Yet should credence be given to the idea of a division during the eighteenth century between the “Republic of Letters” and the “Republic of Sciences?” Did the era of the professional scientist come with the Enlightenment? The impact of the institution shows how fragile this distinction remains. While “philosophers” appear to have gradually reserved social and political reflection for themselves, they nevertheless remained passionate about science. Voltaire (1694-1778) made himself the champion of Newtonism in France, while Denis Diderot (1713-1784) devoted himself to mathematical essays. Numerous academies, for that matter, promoted “Sciences and Belles-Lettres” in their name, such as the prestigious Royal Academy in Berlin. Nicholas de Condorcet (1743-1794)—simultaneously the permanent secretary of the Paris Academy of Sciences and a member of the Académie française—fully illustrates this ambiguity, which endured during the late eighteenth century despite the appearance of specialized scientists. The figure of the American Benjamin Franklin (1706-1790), who was popular among all and had each of his visits to the Old World turned into a triumph by the European public, also demonstrates this entanglement. Who exactly was being acclaimed, the old sage, the scientist, or the pamphleteer? This is perhaps an overly simplistic division. Montesquieu (1689-1755) and the physiocrats, the Scottish members of the Enlightenment, and Adam Smith (1723-1790) all believed they were developing a “science” of government and society.

New publics, new practices, new locations

Despite desire on the part of states to maintain control, institutions of knowledge were in no way a normative and equal framework for the promotion of knowledge in all places. Many provincial academies were of course content to replicate local hierarchies and sociabilities in their recruitment, and the Sorbonne stood out through its conservatism in the service of censorship. In contrast, the universities of Montpellier, Leiden, Scotland, and Germany were leading centers for scientific experimentation in Europe. However, when the same academies created public competitions that awarded prizes and published prize-winning dissertations, they helped establish a circuit of competitions on the European scale, which would become a gateway into the Republic of Letters and Sciences. For example, it was for the Academy of Dijon that Jacques Rousseau gave his famous

Discours sur les sciences et les arts in 1750, which launched his career. It was for the journal *Berlinische Monatschrift* that Emmanuel Kant (1724-1804) drafted the influential (but already almost retrospective) *What is Enlightenment?* in 1784. It was once again from a competition, this time organized by the English Parliament in 1714, that the reliable calculation of longitudes emerged.

Beyond established frameworks, the circle of institutions devoted to knowledge and scientific experimentation expanded to include learned societies, *lycées*, museums, economic and artistic societies, exhibitions of machines, and conferences and public demonstrations. These new locations were highly present in the city and captured the urban public, such as the electric experiments of l'abbé Jean Antoine Nollet (1700-1770), or demonstrations of aerostats above Paris (1783), Edinburgh and London (1784), which were major events that enlivened the end of the century. New actors appeared alongside men of science established in academies, including demonstrators, engineers, and even entertainment entrepreneurs and charlatans. A genuine state administration of scientific proof appeared in order to evaluate discoveries, notably with the creation of commissions within academies. They did not hesitate to publicly invalidate the physical "discoveries" of Jean-Paul Marat (1743-1793), or the magnetic fancies of a Franz-Anton Mesmer (1734-1815), who was expelled from the Vienna Faculty in 1778, and later condemned by the Paris Academy of Sciences in 1784.

With the rise of new circles such as masonic lodges and salons, literary or scientific reputation began to free itself from its sole affiliation with state institutions of knowledge. Salons represented one of the steps toward institutional distinctions, especially during the eighteenth century. While they did not engage in science or the arts, they allowed entry into the shared empire of a *bon ton* and *bon goût*. Feminine sanction could prove decisive within this context, especially in France. This model, which was spread by French diplomatic and academic networks throughout Europe, made Paris a necessary stop on the journey of young British and continental nobles on the Grand Tour. Paris was also where one could see the true stars that were Franklin and Jefferson, who had come to rub shoulders with a lettered and erudite society. The watchword of the circulation of ideas inherited from the Republic of Letters unfolded there in the form of a select sociability. While political discussion was left at the doors of salons, these alternative circles to those of the prince offered opportunities for exchange and meetings that could not be neglected in careers of knowledge. From the encyclopedists to the final members of the Enlightenment during the Ancien Régime (Condorcet, Lavoisier, Buffon), most if not all helped maintain the dynamism of this other circle of "enlightened" science.

The expansion of the public for the arts and sciences helped increase the places where knowledge was discussed, such as coffeehouses, clubs, conferences, painting salons, and concerts. Although monitored by authorities, they allowed for a more free form of expression to emerge. Along with these new publics there developed societies with customs that were less elitist than academies, with more open audiences ranging from trade and entrepreneurial elites to enthusiasts and even women. These

new circles included numerous “museums” and “lycées” that flourished in European capitals, such as those of the scholar Antoine Court de Gébelin (1725-1784), or the aviation pioneer Jean-François Pilâtre du Rosier (1754-1785). While at the end of the century the British painter Joseph Wright of Derby (1734-1797) celebrated the illumination of spectators by a scientific prophet, the caricaturist James Gilray (1756-1815) made fun of their enthusiasm for experimental demonstrations that were more akin to funfair attractions than science.

The discussion of scientific arguments and the interpretation of experiments took place in a space of expression that was further broadened by the circulation of a press increasingly specialized by fields of knowledge, with pharmacy, chemistry, mineralogy and metallurgy (among others) henceforth having their own readership and public. It was also more critical in its reports, whether they were aesthetic, scientific, or political. Despite the censorship implemented by all monarchies, from the most absolute to the most liberal, publications took hold within the landscape of urban societies. They crossed borders and created a genuine European network of production and diffusion ranging from official texts to more scandalous “*nouvelles à la main*” (hand-written newsheets). These circulations led to a paradoxical situation in which France (and especially Paris)—the model of the absolute monarchy and the censorship that came with it—became the center of a European philosophical debate regarding works printed abroad by the publishers of Diderot (1713-1784), Holbach (1723-1789), Helvétius (1715-1771), and Brissot (1754-1793) located in Switzerland, London, Antwerp, and Amsterdam.

These circulations also included individuals, who crisscrossed the continent. The traditional *peregrinatio academica*, and journeys (sometimes forced) of Montesquieu, Voltaire, or David Hume (1711-1776), were joined by academic and masonic visits, as well as urban, thermal, and even archeological tourism, as people rushed to the recently excavated sites of Pompeii and Herculaneum. These circulations forged a shared culture of Europe and Europeans, still largely reserved to noble elites.

For the major explorers whose missions were financed by the state, the unveiling of the world became a spectacle. A large public took an avid interest in the accounts of maritime sagas by James Cook (1728-1779), Louis-Antoine de Bougainville (1729-1811), and the soon-to-be disaster of Jean-François de La Pérouse (1741-1788?). This world was nevertheless more imaginary than discovered. Exoticism and orientalism were often reflexive in usage, drawn toward the introspection of Europeans before the mirror of the world, such as Montesquieu’s Persans (1721), Voltaire’s Chinese and Tatars (1776), or Diderot’s Tahitians (1772). These figures became the subject of customary cultural consumption in the promotion of European civilization and its supposed superiority. They were echoed by the increasingly commonplace colonial commodities that some presented as the tribute made by the savage to the civilized. While this classified and normative—but largely dreamt—world was the

subject of covetousness and domination, and expressed an as yet inaccessible ideal, it nevertheless helped forge a nascent European identity during the seventeenth and eighteenth centuries.

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