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Contents

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Disease, Deformity and Health Terrors in 19th-Century Cartoons: A Cultural History of Science

Abstract: *This article analyses the changes that took place in the image of disease during the nineteenth century. Ever since the Enlightenment movement introduced the scientific discourse into popular knowledge in the eighteenth century, a popular scientific culture had developed and been disseminated. The "cultural visualisation" of science via exhibitions, fairs and illustrated publications became even more intense and widespread in the nineteenth century. In this context, satirical images linked to scientific development proliferated. An analysis of this visual language makes it possible for us to learn more about the development of science and its social impact. I analyse the creation and circulation of iconographic sources, with particular emphasis on French and British sources concerning medical and epidemiological subjects. The aim is to understand the visual tradition that shaped these images and its impact on social imaginary. For that purpose, I examine scientific illustrations from the Early Modern to the Modern Era, in order to better understand their iconography and the ways symbolic language concerning epidemic diseases – mainly cholera – spread across Europe in the nineteenth century.*

Key words: *Cultural History – Science – Caricature – 19th century – Disease*

In 1890, the French writer and illustrator Albert Robida published *La Vie éléctrique* [The Electrical Life], a novel in which he reflected humorously upon the future of society. "La lutte contre le microbe" [The Fight Against the Microbe] and "Migraines scientifiques" [The Scientific Migraines] are two illustrations published in this work, which reflect the scientific revolution in nineteenth-century socio-cultural discourse [Illustrations 1–2]. Based on the theories of visual reception developed by Michael Baxandall, both images help us understand the point to which the discourse of science was internalised by the population. Baxandall has argued that each person has a set of visual codes based on his/her experience and social context, which he calls a "period eye". According to his theory, artists unconsciously incorporate their visual language into their work and translate it into visual structures. At the same time, the reception of this visual code depends on the "cognitive style", meaning that an artistic work is perceived according to the categories, visual

schemes and processes of deduction and analogy of each person, which are determined by her/his own experiences.[1]

Robida's illustrations reflect the capacity of modern society to understand visual codes related to scientific knowledge and practices. "La lutte contre le microbe" includes the language of microscopy, which had been spread among the broader public since the eighteenth century. Robida was able to caricature this language through the representation of microbes monsters that could be vanquished. At the same time, this representation exemplifies the improvements of microscopy throughout the nineteenth century, improvements that enabled the turning of unknown terrors into known threats. These monsters of modernity appeared transformed into evil test tubes and flasks in "Migraines scientifiques" with a visual code that reminds us of Goya's etching, "El sueño de la razón produce monstruos" [The Sleep of Reason Produces Monsters].

Illustration 1–2 [left to right]: "La lutte contre le microbre – médaille d'honneur de M. Philox Lorris" and "Migraines Scientifiques" (Albert Robida, 1890; Gutenberg.org)

Between the seventeenth and nineteenth centuries an evolution took place in knowledge about nature, as well as a break with the beliefs that had been held during the medieval period, giving rise to what is known as the *scientific revolution*. This concept frames a process of scientific, cultural and social change concerning the world-view (*Weltanschauung*) and perception of society; it includes the de-legitimisation of medieval beliefs due to the articulation and dissemination of the scientific theories of Galileo, Descartes or Pascal, among others. The first phase is delimited by the theories of Nicolaus Copernicus and Isaac Newton, which established the ground for a new cosmology and a union between mechanics and mathematics. The following phase was characterised by the development of

1 Michael BAXANDALL, *Painting and Experience in 15th century Italy*, Oxford 1978.

the so-called *modern sciences* – biology, physics, chemistry – and the legitimisation of the discourse of science in society, particularly during the eighteenth and nineteenth centuries.[2]

Before the Enlightenment, the fascination with sciences was reflected in cabinets of curiosities, via which a part of nature was catalogued and exhibited to select visitors. Scientific production linked to these collections grew in the eighteenth century, due to the creation and consolidation of scientific institutions linked to the armies, navies and institutions of government and encouraged by the Court.[3] Enlightened monarchies intervened in the strengthening of scientific academies, such as the French Academy, intensely supported by Louis XIV, and in the inauguration of new ones such as the Imperial Academy of Sciences of Saint Petersburg founded by Peter I of Russia in 1724 and the Royal Academy of Sciences of Stockholm created by Frederick I of Sweden in 1739.[4] These new arenas for the development and exhibition of knowledge invited an approach to the world of the sciences from a new perspective, beyond academic texts. They encouraged a visual experience, and represented the roots of a culture of scientific curiosity that reached its peak in the nineteenth century.[5]

Nineteenth-century society provided the conditions for scientific knowledge to become part of the social discourse: a mass culture that could absorb well-established scientific concepts, a socially-recognised erudite community and a widespread conviction that the sciences were useful for society.[6] A scientific and at the same time popular culture was disseminated, promoting a "cultural visualisation" of science via exhibitions, fairs and illustrated publications.[7] This idea was reflected in the term "vulgarisation", a concept that became common in French after the 1800s, describing the need to make science available to the entire population.[8] Within this context, satirical images linked to scientific development became commonplace. Therefore, an analysis of this visual language informs us about the new technology, as well as developments in scientific knowledge and practices and their

2 Simone MAZAURIC, *Histoire des sciences à l'époque moderne*, Paris 2009; Gérard JORLAND, *La notion de révolution scientifique aujourd'hui*, Revue européenne des sciences sociales 124, 2002, pp. 131–146.

3 Antonio LAFUENTE GARCÍA – Juan PIMENTEL, *La construcción de un espacio público para la ciencia: escrituras y escenarios en la Ilustración Española*, in: Luis García Ballester (ed.), Historia de la ciencia y de la técnica en la Corona de Castilla, Siglo XVIII, Valladolid 2002, pp. 111–156.

4 Jean PIERRE CLÉMENT, *Historia de la ciencia y de la técnica*, Madrid 1993.

5 Agustí NIETO-GALÁN, *Los públicos de la ciencia. Expertos y profanos a través de la historia*, Madrid 2011, pp. 81–92.

6 Bruno BÉGUET, *La vulgarisation scientifique en France de 1855 à 1914: contexte, conceptions et procédés*, in: Bruno Béguet (ed.), La science pour tous. Sur la vulgarisation scientifique en France de 1850 à 1914, Paris 1990, pp. 6–29, here p. 7.

7 Jennifer TUCKER, *The Historian, the Picture and the Archive*, Isis 97, 2006, pp. 111–120, here p. 114.

8 Describe in Bernadette BENSAUDE-VINCENT, *Splendeur et décadence de la vulgarisation scientifique*, Questions de communciation 17, 2010, pp. 1–11; IDEM, *Un public pour la science: l'essor de la vulgarisation au XIX siècle*, Réseaux 58, 1993, pp. 47–66.

social impact. In this article, disease is understood as a socio-culturally influenced reality with a dual biological-cultural nature.[9] Basing my position on this premise, I analyse the creation and circulation of iconographic sources concerning epidemics and medical issues, with a particular focus on French and British sources. The aim is to understand the visual tradition of these images and their role in the construction of the social imaginations linked to the concept of the sick, disease and contagion. Therefore, this work also includes the precedents of scientific illustrations from the Early Modern Era, in order to understand the origins of the iconography and symbolic language deployed when epidemic diseases – first and foremost cholera – ravaged Europe in the nineteenth century.

The Iconography of Disease

The role of images in the field of the sciences has mainly been studied from two perspectives: on the one hand, research into the origin and development of scientific illustrations[10]; and on the other hand, an analysis of the representation of the sciences in the history of art. In the last decades of the twentieth century, a new approach emerged within the framework of the cultural history of science. It focuses on the means of production and communication regarding the scientific field, and on the ways in which the sciences were represented.[11] The researchers who endorse this approach are interested in the visual and material culture of science. The visual and material cultures of science have been studied only recently; nevertheless, they have played a key role in the configuration of scientific and technical knowledge and in scientific and technological development. Maps, diagrams, mathematical analyses, statistical works, drawings, etc., are codes that are used to explain scientific cognition, invisible and intangible to the senses.[12]

There exists a vast bibliography on visual representations of science.[13] The observations and research carried out by naturalists during the scientific expeditions that took place from the sixteenth to the eighteenth century have been extensively analysed by anthropologists,

9 Jon ARRIZABALAGA, *Cultura e historia de la enfermedad*, in: Enrique Perdiguero – Josep M. Comelles (eds.), Medicina y cultura. Estudios entre la antropología y la medicina, Barcelona 2000, pp. 71–82; Charles E. ROSENBERG – Janet L. GOLDEN (eds.), *Framing disease. Studies in Cultural History*, New Jersey 1992.

10 Nicola MÖSSNER, *Visual Representations in Science: concept and epistemology*, London 2018; Klaus HENTSCHEL, *Visual Cultures in Science and Technology: a comparative history*, Oxford 2014; M. NORTON WISE, *Making Visible*, Isis 97, 2006, pp. 75–82.

11 Juan PIMENTEL, *¿Qué es la historia cultural de la ciencia?*, Arbor. Ciencia, Pensamiento y Cultura 743, 2010, pp. 417–424, here p. 421.

12 N. WISE, *Making Visible*, pp. 75–77.

13 John KEAN, *The Art of Science: remarkable natural history illustrations from Museum Victoria*, Melbourne 2013; Brian J. FORD, *Images of Science: a history of scientific illustration*, London 1992.

art historians and historians.[14] However, the ways in which medicine and medical subjects have been represented in art has mostly been analysed within the methodological framework of art history.[15] This is no surprise, taking to consideration the fact that medical topics have found their way into artistic representations since Antiquity.[16]

A great part of the artistic representations of medicine, disease and epidemic is associated with representations of the human body. Death and suffering have been a constant in art, though their representations have varied greatly. The interest in representing these phenomena has led to a substantial amount of portrayals of dying and suffering people, of tormented, sick, wounded and deformed bodies, though there is a differentiation in this pictorial tradition between the depiction of the ill and suffering person on the one hand, and the representation of disease on the other.[17] The plague was one of the most common ways of representing disease in the fine arts. The representation of the plague epidemic reached its peak of popularity in the sixteenth and seventeenth centuries, when Europe was – again – devastated by this pathology.[18] The symbolic universe created during the Black Death of the mid-fourteenth century served as a reference point for Renaissance and Baroque artists.[19] They mostly focused on three plague-related issues: the effects of the epidemic, the religious aspects and, to a lesser extent, medicine.[20]

During the Baroque period, artists often represented the effects of an epidemic on the population. "La Grande peste de Naples de 1656" [The plague in 1656] by Micco Spadaro or "La Peste d'Asdod" [The Plague of Ashdod] by Nicolas Poussin are examples of the style used by artists to dramatise the tragedy. On the one hand, architectural landscapes illustrated the consequences of the disease in public places. On the other hand, illustrations in classicist style sought inspiration in literature and the Bible. The representations reflected the way in which the disease was perceived and handled by the people. The epidemic was understood as a visitation of an angry god, a divine punishment for sins that required

14 Anna LAURENT, *Botanical Art from the Golden Age of Scientific Discovery*, Chicago 2016; Miguel Ángel PUIG-SAMPER, *Illustrators of the New World. The Image in the Spanish Scientific Expeditions of the Enlightenment*, Culture & History Digital Journal 2, 2012, pp. 2–28.

15 Domenico BERTOLONI MELI, *Visualizing disease: the art and history of pathological illustrations*, Chicago 2017; Julie ANDERSON et al., *The art of medicine: over 2,000 years of images and imagination*, Chicago 2011; Alejandro ARIS, *Medicina en la Pintura*, Barcelona 2002.

16 Jean ROUSSELOT (ed.), *Medicine in art: a cultural history*, New York 1967.

17 Carlos REYERO, *La belleza imperfecta: discapacitados en la vigilia del arte moderno*, Madrid 2005, pp. 10–12.

18 George CHILDS KOHN (ed.), *Encyclopedia of plague and pestilence: from ancient times to the Present*, Nueva York 2001.

19 Jean-Marc LÉVY, *Médecins et malades dans la peinture européenne du XVIIe siècle*, Paris 2008, p. 29.

20 Milagros LEÓN VEGAS, *Arte y peste: desde el medievo al ochocientos, de la mitología a la realidad social*, Boletín de Arte 30–31, 2009–2010, pp. 223–238, here pp. 225–226.

public expiation.[21] Visual representations of the plague were therefore an embodiment of a correlation established in that period between religiousness and health. The plague was identified as a sign of divine wrath: Christ throwing arrows – symbolising the plague – at the people. Saints and virgins in praying postures interceded on behalf of the sinning people. It is common to find compositions that represent Saint Sebastian, Saint Roch and Saint Charles Borromeo – protectors from the plague – during this period. Alongside them, one of the most popular representations was that of the Virgin of Mercy protecting the people with her cloak.[22] This iconography dated from the thirteenth century and became widespread after the devastation caused by the Black Death in the fourteenth century. This image continued to circulate during the sixteenth and seventeenth centuries.[23]

Illustration 3: "The Virgin of Mercy responding to the intercessions of the saints by protecting people from arrows symbolising disease; the Devil rules below, where the plague attacks the land", (15th century, Wellcome Collection. Attribution 4.0 International, CC BY 4.0)

21 Roy PORTER, *What is disease?*, in: Roy Porter (ed.), The Cambridge Illustrated History of Medicine, Cambridge 1996, pp. 82–117, here p. 88.

22 Raymond CRAWFURD, *Plague and Pestilence in Literature and Art*, Oxford 1914.

23 J.-M. LÉVY, *Médecins et maladies*, pp. 53–56.

These religious connotations had shaped the visual imaginary built around the epidemics since the Early Modern Era. A moral discourse developed concerning diseases, blaming the sick for their illness. The reasoning went as follows: one's body was unhealthy because one's soul was sick. Disease was understood as a consequence of immoral, sinful acts promoted by demons. Contagion was associated with a diabolic curse that was transmitted from person to person, equating possession with disease. As a result, the visual culture was impregnated with a pictorial discourse in which diseases were spread by monsters from the underworld. These visual codes include compositions in which the origin of the infections is linked both to the anger of God and to the action of the Devil.[24] An example of this is the "Madonna della Misericordia", a panel painting at the San Francesco del Prato church in Perugia. The image reflects the idea of the divine origin of the plague and its propagation by the Devil. This representation – a work by Benedetto Bonfigli from 1464–depicts the Virgin of Mercy protecting the religious community with her cloak.[25] Above her, Christ throws arrows of the plague, which are intercepted by the Virgin's clothes. The angels of Justice and Piety stand next to Christ. At the bottom of the piece is a representation of the city of Perugia threatened by a winged monster, symbolising the death or the Devil. The creature carries a bow and arrows, using them to attack the population, of whom numerous victims can be seen lying on the floor [Illustration 3].

This iconography was strongly linked to the way monsters had been perceived throughout history. These creatures symbolise a breach of the natural order, and their images embody anomalies of society, all that is not adapted to established rules.[26] Consequently, the representation of pathologies and corporal distortions is permeated by a pictorial tradition influenced by the mythological, monstrous and fantastical imagery that had dominated until the beginning of the nineteenth century, when a scientific explanation of monsters became possible, widely understandable and acceptable.

The Monster of Science

From the fifteenth century on, visual culture became enriched by links established among medicine, art and philosophy. Anatomical dissection became popular, due to the interest of artists and naturalists in the representation of the body. In the sixteenth century, medical

24 R. PORTER, *What is disease?*, pp. 102–108.

25 Diana BULLEN PRESCIUTTI, *Visual Culture of Foundling Care in Renaissance Italy*, London 2015, pp. 25–26.

26 Antonio LAFUENTE – Nuria VALVERDE, *¿Qué se puede hacer con los monstruos?*, in: Antonio Lafuente (ed.), Monstruos y seres imaginarios de la Biblioteca Nacional, Madrid 2000, pp. 17–37, here pp. 17–19.

concepts and practices were gradually introduced into the socio-cultural discourse in Europe, particularly in intellectual circles. As for anatomy, illustrated dictionaries and handbooks adopted a style that emphasised description and analysis, rather than mere curiosity and fascination. In the seventeenth century, a deep and systematic knowledge of human anatomy led to the configuration of a canon of the human body, while any deviation from it was construed as anti-natural and therefore monstrous.[27]

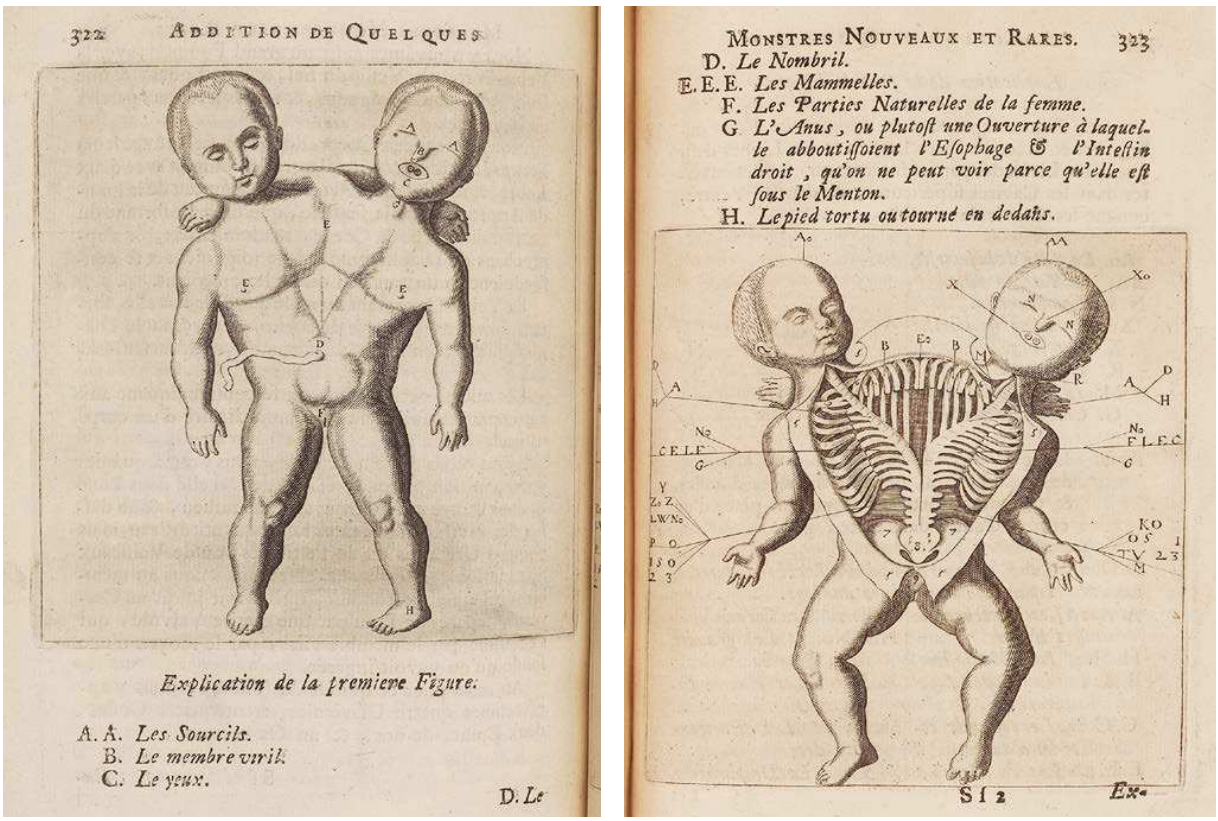

Illustration 4 (1–2): Images published in *Description anatomique des parties de la femme qui servent à la génération, avec un Traité des monstres, de leurs causes, de leur nature et de leurs différences, et une description anatomique de la disposition surprenante de quelques parties externes et internes de deux enfants nés dans la ville de Gand, capitale des Flandres* (Jean Palfyn, 1708; Gallica / Bibliothèque nationale de France, département Arsenal, 4–S-2599)

In the eighteenth century, the growing medical understanding of the frequency and variety of deformities in humans and animals and the overall secularisation of the medical imagination led to the naturalisation of monsters; rather than being labelled as anti-natural,

27 Joaquin FORTANET, *Anatomía de la monstruosidad: la figura del monstruo como objeto de la mirada médico-anatómica moderna*, Asclepio 67, 2015 [online]. URL: <http://dx.doi.org/10.3989/asclepio.2015.14>, [accessed 24th April 2020].

these creatures began to be classified as "monstrosities of nature"[28] Scientific handbooks included illustrations showing bodies with deformed limbs and skin. Bestiaries and treatises on monstrosity became popular, in which bodies with congenital or acquired deformities were associated with mythological figures and fantastical creatures. Therefore, many descriptions of illness and malformation were related to the unusual and the anecdotal[29] [Illustrations 4]. All persons affected by a corporal deformation – conjoined twins, a hermaphrodite, a dwarf – or by a skin disease was classified as a "monster of natural body," bodies marked as beyond the norms of nature.[30]

Scientific practices, including dissection, classification as well as detailed textual and visual representations, helped demystify monsters. From the eighteenth century on, the monster of nature became seen as a curiosity. The bizarre and the strange fascinated the society of the day, being considered an object of contemplation rather than deserving of rejection.[31] At the same time, the publication of scientific handbooks describing these subjects created a visual album of deformity and disease in which monstrosities were presented and analysed like other biological elements. This visual culture concerning the monster redefined its artistic representation, moving further away from the fantastical and supernatural. The visual language now included a code transferred from the field of the sciences into popular culture. For this reason, during the eighteenth century, there were large similarities in the iconographic compositions illustrating scientific works about overseas expeditions, publications about world curiosities and satirical pictures [Illustrations 5 (1–3)].

28 As in *Les Ecarts de la nature, ou Recueil des principales monstruosités que la nature produit dans le genre animal* of Nicolas-François Regnault edited in París in 1775 in the illustrated supplement of *Histoire naturelle générale et particulière, servant de suite à l'histoire naturelle de l'homme* of Jacques de Dessinateur edited in Paris in 1777.

29 Domenico BERTOLONI MELI, *Visualizing disease*, pp. 23–52.

30 A. LAFUENTE – N. VALVERDE, *¿Qué se puede hacer con los monstruos?*, pp. 27–28.

31 Michael HAGNER, *Utilidad científica y exhibición pública de monstruosidades en la época de la Ilustración*, in: Antonio Lafuente (ed.), Monstruos y seres imaginarios de la Biblioteca Nacional, Madrid 2000, pp. 107–127.

Illustrations 5 (1–3) [left–right]: Image published in *A description of the coasts of north and south-Guinea, and of the Ethiopia inferior, vulgarly Angola* (Jean Barbot, 1732; Wellcome Collection. Attribution 4.0 International, CC BY 4.0); "A girl suffering from a skin disease, identified as multiple fibroma" (Alex Hogg & Co, 1805; Wellcome Collection. Attribution 4.0 International, CC BY 4.0); satirical print "Louis XVIII, le Désiré" (18th–19th century; Gallica / Bibliothèque nationale de France, département Estampes et photographie, RESERVE QB-370 (69)-FT 4)

Caricaturists took and exploited the visual code created within the framework of the scientific revolution. By the end of the Enlightenment, political and social revolutions promoted a new bestiary, a work of satirical illustrators that combined scientific and fantastical imaginary. It was common to find images representing different kinds of monsters, such as "Le Géant Iscariotte Aristocrate" [The Giant Aristocratic Iscariot] [Illustration 6]: "a figure with snake hair and crowned with spikes, which attacks anyone

who opposes tyranny". This picture circulated in France during 1789 and 1790, and it was part of a set of satirical revolutionary illustrations against absolutism, in which various monstrosities embodied the enemies of the Revolution. The illustration of this giant was linked to a tale circulating at that time that combined fantastical and biblical elements. Its name has a double meaning: Iscariot refers to Judas and his betrayal of Christ, who in this context symbolised freedom. Moreover, the letters of Iscariot composed an incomplete anagram of "aristocrat".[32] This monstrous giant stood for the perversion and corruption of the monarchy, an evil plaguing the freedom and civilisation represented by the Revolution. For this reason, the monster was represented as a "savage man" following descriptions of other ethnicities in books narrating scientific travels during the eighteenth century.[33]

Illustration 6: "Le Géant Iscariotte Aristocrate" (1789; Gallica / Bibliothèque nationale de France, département Estampes et photographie, RESERVE QB-370 (21)-FT 4 [De Vinck, 3659].

32 Antoine DE BAECQUE, *La France de la Révolution*, Paris 2011, pp. 141–146; Antoine DE BAECQUE, *Iscariotte, géant aristocrate ou l'image monstre de la Révolution*, Annales historiques de la Révolution française 289, 1992, pp. 323–332.

33 A comparative exercise can be conducted with the illustrations published in *the Encyclopédie des voyages, contenant l'abrégé historique des moeurs, usages, habitudes domestiques, religions, fêtes…* of J. Grasset Saint-Sauveur edited Paris in 1796.

The visual code of the sciences was only one of the tools used by satirical illustrators to represent their thoughts. The influence of scientific discourse went much further and became part of the compositional message of cartoonists from the mid-eighteenth century. Thus, for example, the work on physiognomy by Johann Caspar Lavater – *Physiognomische Fragmente zur Beförderung der Menschenkenntnis und Menschenliebe* published between 1775 and 1778–was used by British and French caricaturists to criticise the double standards of important persons in society.[34] In his treatise, Lavater took up an old theory outlined by Aristotle in his *Physiognomica*, according to which one could tell people's character from their external appearance. Lavater popularised the physiognomic theory throughout Europe, and spread the belief that the external appearance of each person was a clear reflection of their inner nature, extrapolating it to the explanation of their acts.[35] This theory influenced satirical illustrators, as reflected in *Doublûres (sic) of characters* (James Gillray, 1798). The caricature plays upon the conclusions of Lavater's essay, portraying several opposition leaders – Charles James Fox, Francis Burdett or the Duke of Bedford – next to their alter-egos, which show their true personality.

This kind of image could only appear with the popularisation of science, a democratisation of scientific knowledge whose bases were established in the *Encyclopedie* project.[36] The Enlightenment built the scaffolding that helped transform the nineteenth century into an era of dissemination of scientific knowledge. The opening to the public of the cabinets of natural science, the creation of permanent exhibition spaces of natural history collections, the inauguration of *conservatoires* of arts and sciences where men could receive training in applicable scientific and technical knowledge and skills, and the popularisation of scientific spectacles made this field of knowledge accessible to a larger audience.[37] Publications aimed at the dissemination of the sciences had appeared before the eighteenth century; however, from the 1800s,[38] there were editorial companies that specialised in publishing books addressing a wider readership. With regard to medicine, as Darina Martykánová and Víctor-Manuel Núñez-García illustrate in their article in this special issue, this type of publication appeared in eighteenth-century Europe, aimed at the learned public.[39] The

34 Laurent BARIDON – Martial GUÉDRON, *L'art et l'histoire de la Caricature*, Paris 2015, pp. 28–31.

35 John GRAHAM, *Lavater's Essays on Physiognomy: A Study in the History of Ideas*, Bern 1986.

36 Bernadette BENSAUDE-VINCENT, *Un public pour la science: l'essor de la vulgarisation au XIXe siècle*, Reseaux 58, 1993, pp. 47–66, here p. 50.

37 Daniel RAICHVARG – Jean JACQUES, *Savants et ignorants: une histoire de la vulgarisation des sciences*, Paris, 2003, pp. 52–71.

38 In Spain, William Buchan's manuals were translated from the end of the 18th century. In 1785, *Medicina Doméstica* [*Domestic Medicine*] was published in Spanish and in 1808, *El conservador de la salud de las madres y de los niños* [*Advice to mothers, on the subject of their own health; and on the means of promoting the health, strength and beauty of their offspring].*

39 Darina MARTYKÁNOVÁ – Víctor-Manuel NÚÑEZ-GARCÍA, *Vaccines, Spas and Yellow Fever: Expert Physicians, Professional Honour and the State in the Mid-Nineteenth Century,* Theatrum historiae 27, 2020, pp. 7–30.

translation of these works into other languages soon after they were published demonstrates their broad popularity and circulation. From the 19th century onwards, books on "household medicine" became popular in Europe and America, such as the books by William Buchan and Samuel-André Tissot.[40] The hygienist discourse was gradually introduced into the social discourse due to popularising works such as those written by François Vicent Raspail.[41] His *Le Manuel annuaire de la santé* [The Health Yearbook] was a true bestseller. This reference work began its publication in 1846 and ended with the death of its creator in 1878, representing one of the most long-lived dissemination publications.[42]

The editorial world soon grasped that there was an increase in demand for information on medical and hygienic issues. Periodical publications on these subjects began to emerge from the beginning of the nineteenth century, such as *Gazzete de santé* (1833–1836) [Journal of Health] and *Diccionnaire de la santé et des maladies* [the Health and Disease Dictionary]. Health became part of the public debate and so-called "social medicine" emerged, a set of rules of hygiene promoted by experts and implemented by governments and municipal authorities and disseminated via periodical publications and specialised dictionaries.[43]

These works described good habits in terms of hygiene, and usually included illustrations representing the main symptoms of diseases and preventive action to be taken against contagion. The use of illustrations in such publications was part of a general phenomenon from the mid-eighteenth century. During this period, prints of all kinds circulated in large numbers both in France and in Great Britain. The fact that such circulation was extremely common can actually be deduced from the frequent attempts to limit it by the authorities, in order to control particularly the illustrations on political subjects. For example, in 1793 all printers were obliged to send a copy of every image they printed in their workshop to the government. However, this control was impossible because of the very nature of the print, which circulated as an independent object even though it was originally part of an editorial collection or handbook.[44] This wide circulation of images took place because of illiteracy levels; in the early nineteenth century the literacy rate was approximately 60% among adult men in both France and Great Britain, reaching a similar rate throughout the whole

40 Agustí NIETO-GALÁN, *Los públicos de la ciencia: expertos y profanos a través de la historia*, Madrid 2011, p. 54.

41 José PARDO TOMÁS, *De los libros de secretos a los manuales de la salud: cuatro siglos de popularización de la ciencia*, Quark 37–38, 2005–2006, pp. 30–38.

42 Jacques POIRIER – Claude LANGLOIS (eds.), *Raspail et la vulgarisation médicale*, Paris 1992.

43 Isabelle DUSSERT-CARBONE, *Les diccionaires de vulgarisation médicale au XIXe siècle en France*, in: Bernadette Bensaude-Vincent – Anne Rasmussen (eds.), La science populaire dans la presse et l'edition XIXe et XXe siècles, Paris 1997, pp. 87–102.

44 Robert Justin GOLDSTEIN, *Censorship of Political Caricature in Nineteenth-century France*, Kent 1989, pp. 93–94.

population by the middle of the century.[45] Individual prints, engravings, leaflets and posters were a common tool of expression capable of reaching a larger public, in comparison for instance with painting on canvas, which to a great extent was monopolised by the social elite and exhibited in privileged spaces.[46]

This regular use of images is also seen in publications on health and sciences, such as the work of Thomas Bateman, who in 1817 published *Delineations of Cutaneous Diseases*, a visual atlas that represented known skin diseases. These specialised handbooks were not the only illustrated publications; works intended for a non-expert audience, such as the aforementioned *Domestic Medicine* by William Buchan, also influenced the work of the cartoonists who took these health manuals as a point of reference for their cartoons. A clear example can be found in *A Cure for a Cold: Here's a go; I must keep my feet in hot water 20 minutes Take two quarts of gruel wrap my head in flanel and Tallow my nose* (Gabriel Shear Tregear, 1833), which illustrates one of the cold remedies explained in Buchan's handbook.

This medical literature influenced the work of satirical illustrators, who came to compose their own medico-satirical "encyclopaedias" consisting of prints such as *The Gout* (James Gillray, 1799) [Illustration 7], *Ague & Fever* (Thomas Rowlandson, 1788) [Illustration 8] and *The Head Ache* (George Cruikshank, 1819). All these illustrations exaggerated the actual manifestations of disease, representing corporal changes such as enormous red noses or disproportionate bellies and extremities.[47] The main difference with respect to the scientific illustrations consisted of explaining the origin of disease by means of the intervention of supernatural creatures. This explanation was inherited from the visual tradition of the Medieval Era. Thus, headaches were caused by the action of little demons, fever and the influenza were caused by monsters from whose claws nobody could escape, and gout was the result of the bite of a certain type of devil.

The illustrations in which illness was associated with the intervention of fantastical and supernatural creatures were present until the end of the eighteenth century. Nevertheless, the spread of scientific knowledge modified the perception of the origin and propagation of pathologies after the first decades of the nineteenth century. The popularisation of scientific tools, in particular, had an important impact. The camera obscura, the magic lantern, the optical box and the microscope were applied within a broadening range of circumstances and burst onto the public stage in the services of entertainment and social life.

45 Carlo M. CIPOLLA, *Literacy and Development in the West*, Harmondsworth 1969; Lawrence STONE, *Literacy and Education in England 1640–1900*, Past & Present 42, 1969, pp. 69–139, here p. 120.

46 Anne SANCIAUD-AZANZA, *Le texte au service de l'image dans l'estampe volante du XVIII^e siècle*, Bibliothèque de l'École des chartes 158, 2000, pp. 129–150.

47 Mortimer FRANK, *Caricature in Medicine*, Bulletin of the Society of Medical History of Chicago 1, 1911, pp. 46–57.

Firstly, the naturalisation of these elements made possible the appearance of scientific and medical objects within a different context and with varied connotations. This is the case of the preserved dead bodies depicted by Charles Joseph Traviès de Villiers in *Foetus politiques morts-n*és, a caricature published in 1834.[48] The illustrator used this conservation procedure – very common in curiosity and natural science cabinets[49] – to explain the end of the government known as the "Tiers-parti", which only survived a few days during the July Monarchy in France. But above all, the most popular medical procedure, at least among the cartoonists, was the clyster, and it was often used outside its medical context. Overall, the use of medical instruments proliferated in political caricatures in the first half of the nineteenth century, these tools becoming common accessories of French politicians. This is the case of the marshal Lobau, represented as a clyster himself, after having dispersed a demonstration in favour of Bonaparte with fire-hoses in 1831.[50]

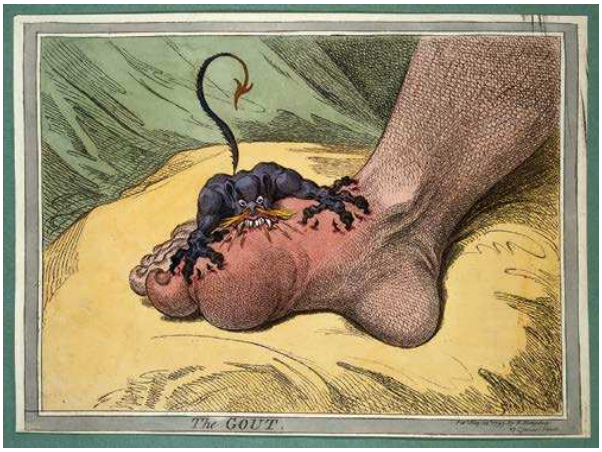

Illustration 7–8 [left to right]: "The Gout" (James Gillray, 1799; Wellcome Collection. Attribution 4.0 International, CC BY 4.0); "Ague & Fever" (Thomas Rowlandson, 1788; Wellcome Collection. Attribution 4.0 International, CC BY 4.0)

Secondly, as they did with botanical and anthropological illustrations of scientific expeditions, the cartoonists adopted codes of representation based on scientific methodology, specifically microscopy.[51] Since 1665, the *Micrographia* of Robert Hooke had popularised illustrations with a microscopic perspective beyond the scientific community. This work

48 Published in *La Caricature,* 20 November 1834, nº 211.

49 Marc HERBIN, *La conservation des collections en fluide. Approche historique et conservatoire*, CeROArt HS, 2013.

50 David S. KERR, *Caricature and French Political Culture, 1830–1848: Charles Philipon and the Illustrated Press*, Oxford 2000, pp. 45–47.

51 Jesusa VEGA, *Ciencia, arte e ilusión en la España ilustrada*, Madrid 2010, pp. 370–372.

triggered a true visual revolution, and around 1000 copies circulated in Europe.[52] But it was only in the nineteenth century that the visual structure of microscopy (a circle – a shape imposed by the lens of a microscope – in which tiny elements of natural world become visible) was incorporated to visual culture, becoming a part of the codes of representation of the society. The images with "a microscopic point of view" were popularised in periodical publications and in other genres such as advertising posters and children's books.

After the Enlightenment, scientific illustrations spread a representation of nature as organised, measured and controlled by human reason. Even so, satirical illustrators turned the message on its head and transformed organised nature into chaos. Microscopy showed an invisible, disorganised world full of unknown creatures compressed into a small place; this idea seeped into the visual imagination that humoristic illustrators applied to social and political compositions. Clear examples of this are found in the works of Baric, a cartoonist of *Le Journal Amusant*, such as: "Etudes microscopiques" and "Une goute de vin vue au microscope", published in the journal in 1862. Both images represent a chaotic scene, a crowd of small figures in different positions and actions. This kind of illustration was used for political subjects: "The Wonders of a London Water Drop" and "Essence of Parliament," two illustrations with a visual code similar to that of microscopy, which appeared in the vastly popular magazine *Punch*, presenting members of parliament as microbes.

The link between microorganisms on the one hand, and chaos and social evil on the other, has its origin in the popularisation of the discourse of science. Next to scientific illustrations about diseases, graphic depictions of microbes and mites circulated in works such as *Histoire Naturelle de la Santé et de la Maladie* of Raspail, published in Paris in 1843. As I have already mentioned, after the Enlightenment, scientific knowledge became part of the social imagination and influenced the perception of monsters.[53] However, within this context monstrosity was not only rationalised but also renovated. Thus, in the first decades of the nineteenth century when the cholera epidemic reached Europe, unidentified microbes were transformed into nightmares of modernity.

Cholera and Invisible Monsters

If, in the Medieval and Early Modern periods, the Devil and other supernatural creatures were the source of evil, then the end of the eighteenth century diseases had their origin in the immoral actions of society. Satirical prints that included references to diseases, insalubriousness or infection become widespread particularly in the times of revolution,

52 A. NIETO-GALÁN, *Los públicos de la ciencia*, p. 48.

53 Katharine PARK – Lorraine J. DASTON, *Unnatural conceptions: the study of monsters in sixteenth-and seventeenth-century France and England*, Past & Present 92, 1981, pp. 20–54, here pp. 51–54.

such as the French Revolution or the liberal revolutions of the first half of the nineteenth century. "La crise salutaire", "Epidémie revolutionnaire" or "La France rétablit sa santé" are examples of this kind of caricature. In "La crise salutaire", disease has taken control of Napoleon's body; the emperor asks a doctor for a solution, he responds that the cure is to reinstall the Old Regime, introducing a pun linking a medical regimen to a political regime. In the same way, watching the supporters of the republic from his window, Louis-Philippe – the last king of France – compares the republican system to rabies in "Epidémie revolutionnaire", published in 1848. In these illustrations, the society falls ill because of a social evil. In both cartoons, which support the absolutist monarchy, the origin of the disease lies in the endorsement of other forms of government. The republicans are depicted as literally rabid, in other words rabies stands for the republic. This iconography is part and parcel of the discourses of that time, with the revolution being compared to the cholera epidemic. Similarly, an opponent of the popular uprising of 1849 expressed it by identifying the epidemic with a "revolutionary infection" and arguing that both evils – cholera and the revolution – "must be eradicated".[54] Such a discourse is shared across political boundaries, being present also among the supporters of the republic, who portrayed the monarchy as a disease for the people and the nation. In another example published at the moment of the abdication of Louis Philippe, the allegory of the French nation exclaims "Me voici purgée de ce ver rongeur" [Here I am purged of this rodent worm]; France rid itself of the parasite that had made her sick, a larva with human face symbolising the monarch [Illustration 9].

Besides political criticism, pathologies were represented in many satirical prints with a social perspective. The advance of cholera or yellow fever, together with the lack of explanations from governments, led to the general feeling of terror of disease, permeating the social discourse in the first half of the nineteenth century. Besides epidemics, crime and alcoholism were also on the rise, and all these evils were linked with the effects of social, industrial and economic transformations.[55] The growth of cities and the increase of their population promoted an uncontrolled urban development, in which the cities were deprived of sanitary infrastructures. For this reason, urban transformations were characterised by the "4 Ds": dirt, disease, deprivation and death.[56]

The protagonists of the social hygienist movement proposed different projects, wrote reports and gave advice to the authorities in an endeavour to improve the situation. Even so, the sanitary problems suffered by the great part of citizens created a lively socio-political debate, pictorial works by cartoonists being part of it. The impurity of the water and its

54 Richard J. EVANS, *Epidemics and revolutions: cholera in nineteenth-century Europe*, Past & Present 120, 1988, pp. 123–146, here p. 135.

55 Ricardo CAMPOS MARÍN, *La sociedad enferma: higiene y moral en España en la segunda mitad del siglo XIX y principios del XX*, Hispania 191, 1995, pp. 1093–1112, here pp. 1093–1095.

56 Ian MORLEY, *City Chaos, Contagion, Chadwick and Social Justice*, Yale Journal of Biology and Medicine 80, 2007, pp. 61–72, here pp. 63–64.

identification as the focus of infection was a common subject of satirical illustrations, especially after the publication of John Snow's research on the contaminated waters in 1849.[57] This message is represented in "Monster soup commonly called Thames water, being a correct representation of that precious stuff doled out to us!!!" by William Heath. He used the visual code of microscopy to illustrate the fauna living in a water drop of the Thames. The picture represents the "microcosmos" of London water, inhabited by horrible and grotesque creatures of different shapes and sizes. The same issue was addressed in "Father Thames introducing his offspring to the fair city of London" published by *Punch* in July of 1858. On this occasion, the Thames was represented as a filthy, semi-human figure that introduced diphtheria, scurvy and cholera to the allegory of the city. Each disease has an unhealthy and disproportionate body.

Illustration 9: "La France rétablit sa santé" (E. Perrot, 1830; Gallica / Bibliothèque nationale de France, département Estampes et photographie, RESERVE QB-370 (107)-FT4)

57 Joan SERRALLONGA URQUIDI, *Epidemias e historia social. Apuntes sobre el cólera en España, (1833–1865)*, Historia Social 24, 1996, pp. 7–21, here p. 10.

Among nineteenth-century epidemic outbreaks, cholera caused great fear and created a lively public debate aggravated by social riots. This disease, unlike some others, made no social distinction. It became a major problem for all social classes, like other epidemics from the past, such as the plague. Medical experts at the service of the public authorities decided to isolate affected areas, building *cordons sanitaires* that restricted the circulation of people. Although in the first half of the nineteenth century the source of infection was unknown, the sanitary control established a social division that resulted in the identification of poor people and marginalised social groups as the possible origin of contagion, because these social groups often lived in an unhealthy habitat.[58] Within this context, the cartoonists represented cholera using two main visual codes: the beast and the monstrous sick.

On the one hand, the tradition of bestiary continued through a visual discourse based on the fantastical imaginary inherited from the Early Modern era. This visual code appeared on public posters that described measures to prevent the contagion or in allegorical illustrations such as the "Portrait de l'Impératrice Eugénie protégeant les villes de Paris et Amiens du cholera" (Léon Brunel-Rocque, Paris, 1866). This picture is a clear example of how a liberal government tried to build a secular iconography using elements from religious visual culture, a common practice since the beginning of the nineteenth century. The pictures that represent the visits of politicians, kings and queens to hospitals were other examples of attempts to create a secular hagiography during a constitutional regime.[59] In this sense, the portrait of the empress Eugénie protecting French cities shares common ground with the depictions of the Virgin of Mercy from the fifteenth and sixteenth centuries.

The allegory of cholera as a beast with an undefined body was linked to the popularity of the miasma theory of the eighteenth and nineteenth centuries. The miasma referred to the union of contaminated substances – water or infected food – as sources of infectious diseases; a belief widespread from the hygienist theories of Thomas Sydenham until the discovery of the microbiological origin of cholera in 1884.[60] The miasma postulate attributed great importance to the alteration of the atmosphere in the spread of cholera or yellow fever.[61] The cartoonists adapted this theory to their visual codes and presented cholera as a faceless creature and accompanied by a fog or contaminated atmosphere, as in the case of *Cholera "Tramples the victors & the vanquished both"* (Robert Seymour, London, 1831).

58 I. MORLEY, *City Chaos, Contagion*, pp. 68–69.

59 C. REYERO, *La belleza impecfecta*, pp. 21–23.

60 Vicente PLA VIVAS, *Del individuo soberano al individuo patógeno. La representación del enfermo y la enfermedad a través de dos ilustraciones Valencianas del XIX*, Ars Longa 9–10, 2000, pp. 231–238, here p. 234.

61 Luis URTEAGA, *Miseria, miasmas y microbios. Las topografías médicas en el estudio del medio ambiente en el siglo XIX*, Geocrítica. Cuadernos críticos de Geografía Humana 29, 1980, pp. 1–34, here pp. 4–5.

Based on these ideas, disease was linked to poverty, as poor nutrition and unhealthy urban areas were identified as the main sources of infection. The idea of that the pauper classes were more affected than others by the epidemic started to circulate; the homeless, drunks and all persons whose morals were considered questionable by the liberal consensus were pointed to as sources of infection, and represented as guilty of spreading the disease in the socio-cultural imagination.[62] On a pictorial level, the focus shifted from the pathology to the patient; the illustrations implied that the sufferer was guilty of the spread of the disease.[63] Thus the social evil ceased to be an external creature and was replaced by the sick themselves, transformed into monsters. Cholera caused diarrhoea and massive vomiting; within a few hours the sick became apathetic, comatose, presenting a grey-blue skin tone and deep-set eyes. The epidemic caused a huge impact among the population, as it could affect anyone, and caused terror reflected in the social imagination.[64] Representations of the infected were based on the following symptomatic picture: blue figures with a thin body, writhing face and aggressive gesture. The patient was transformed into a monster, a creature to run away and hide from [Illustration 10].

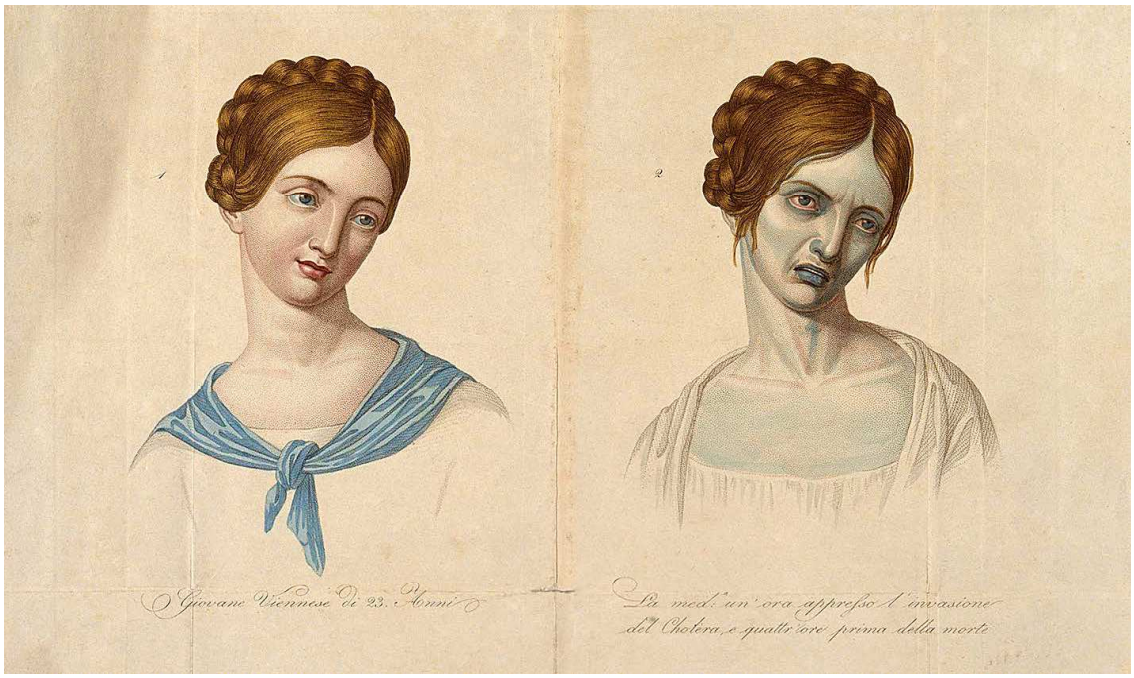

Illustration 10: "A young woman of Vienna who died of cholera, depicted when healthy and four hours before death. Coloured stipple engraving" (1831 approximately, Wellcome Collection. Attribution 4.0 International, CC BY 4.0)

62 I. MORLEY, *City Chaos, Contagion*, p. 67; R. J. EVANS, *Epidemics and revolutions,* pp. 128–129; L. URTEAGA, *Miseria, miasmas y microbios*, p. 6.

63 V. PLA VIVAS, *Del individuo soberano al individuo patógeno*, p. 234.

64 R. J. EVANS, *Epidemics and revolutions*, pp. 127–128.

The cartoonists endorsed this vision and represented the sick as deprived of their human appearance, as we can appreciate for instance in the print *A case of True Cholera* –dating back to 1832–in which several physicians are cleaning the hands and feet of a cholera patient. The sick man barely maintains his human form and looks like a giant larva with reddened eyes; his humanity is only apparent in his bare feet, revealed by his clothes. This image reflects the terror caused by cholera and other epidemic diseases in the nineteenth century. Social fear accompanied by a lack of information and circulation of rumours and incorrect hypotheses made the situation worse, particularly among the most disadvantaged, similarly as in other sanitary crises.[65] Once again, monsters were created in contrast to the parameters of normativity. While in the past the monsters had been people removed from the natural order, in modern times those displaced by the political and social morals were turned into monsters.

In addition to the social fear surrounding the spread of epidemic diseases, the satirical illustrations present another message: a criticism of the scientific discourse and medical practices of that moment. Popular cartoonists as George Cruikshank and Honoré Daumier created some compositions about greedy doctors surrounded by money, who had benefitted from epidemic outbreaks by the sale of healing remedies. In the cartoon "The Central Board of Health",[66] George Cruikshank illustrated a group of physicians celebrating and toasting the spread of the epidemic. These doctors profited financially thanks to the increasing of number of consultations demanded by people and government, wishing to know how treat and reduce cholera symptoms. Very similar is the satirical illustration "An Address of thanks from Faculty to the Risht Hon.ble Mr. Influenzy for his kind visit to this country". The cartoon shows a group of doctors expressing their gratitude to the influenza outbreak. The arrival of the disease means economic and academic profits, and the doctors gain prestige because of their research on the disease. The image represents famous physicians of the medical field such as Pearson, Falconer and Baker, doctors from funded medicine schools and members of important institutions as Royal College of Physicians.[67]

The fear of epidemic diseases lasted throughout the nineteenth century. Nevertheless, the situation changed towards the fin-de-siècle due to the development of the germ theory of disease. After that time, the origin of some diseases was understood, allowing for the development of efficient measures of prevention and/or cure.[68] Microbes and other

65 Manuel FERREIRO ARDIÓNS, *El cólera en las transformaciones del siglo XIX en Álava. La epidemia de 1834*, PhD diss., University of Basque Country, Vitoria 2012, p. 412.

66 "The Central Board of Health", George Cruikshank (1832), The British Museum, Registration number: 1859,0316.201.

67 Renate BURGESS, *A Satire on The Influenza of 1803*, Medical History 23, 1979, pp. 469–473.

68 Jon ARRIZABALAGA – Àlvar MARTÍNEZ-VIDAL – José PARDO-TOMÁS, *La salut en la història d'Europa*, Barcelona 1998, p. 38.

microorganisms of the invisible world were domesticated, in the same way as cabinets of curiosities had exhibited exotic monsters and rendered them less threatening. These creatures were transformed into life forms that were amazing and repulsive at the same time, exposed in public spectacles such as the one announced by the Menus-Plaisirs Theatre in 1883. The spectacle entitled *Les Invisibles* offered a trip to the "infinitely small" world thanks to the use of a giant electrical microscope [Illustration 11]. The poster for the event shows two huge monsters projected onto a stage; the magic lantern spectacle had developed technically so it could show the spectator "tous les monstres effroyables qui grouillent dans une seule goutte d'eau,"[69] as described in *Le Figaro*. The illustration showed the new monsters of science, creatures visible to the human eye thanks to technical development; at the same time the image represented their domestication. Thus society could enjoy them as entertainment under human control.

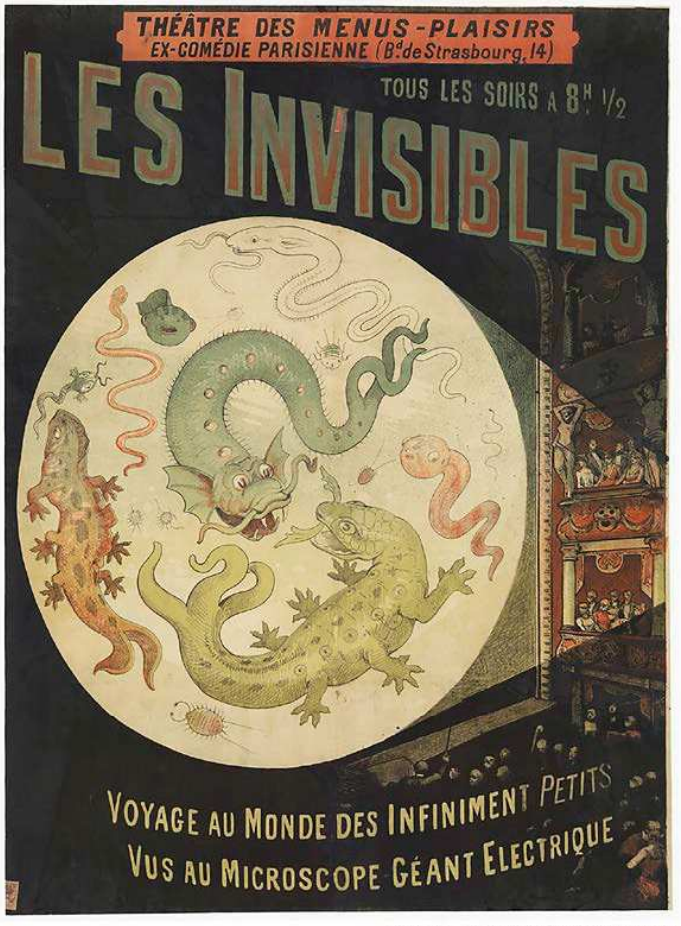

Illustration 11: "Théâtre des Menus-Plaisirs, ex Comédie-Parisienne... Les invisibles. Voyage au monde des infiniment petits, vus au microscope géant électrique" (1883; Gallica / Bibliothèque nationale de France, département Bibliothèque-musée de l'opéra, AFFICHES ILLUSTREES-451)

69 Published in *Le Figaro*, 10 November 1883.

"La Guerre Miasmatique" and other Terrors of the Future

The Great Exhibition of London in 1851 symbolises the starting point of the modern popularisation [*vulgarisation*] of science. One million citizens gathered in the same place for this event, and the audience attending the exhibitions that followed continued to increase, reaching nearly 48 million in the Paris edition of 1900.[70] Scientific dissemination went beyond a utilitarian approach – which had been an important force behind it since the eighteenth century. It was now directed at the whole society, beyond experts and the learned public. The publishing world sensed society's interest in the future of science and technology[71]; companies such as Hachette, Flammarion and Larousse invested in publications focused on scientific popularisation, and created diverse collections targeting children and young people.[72] "La science est partout et dans tout" announced the popular magazine *La Science Universelle* (1865–1861), a slogan reflecting the growth of specialised publications and literary works of scientific popularisation from the 1850s. The target public was diverse, from well-off urban classes to social groups that might have been less wealthy but had intellectual concerns and interests: professional scientists, writers, journalists and skilled industrial workers.[73] Both experts and amateurs provided and publicised scientific information, the weight of each group differing from one country to another. In France, scientific dissemination was highly professionalised, the popularisers of science tended to have strong links with the French Academy of Sciences.[74]

Within this context a hybrid scene emerged, marked by the publication of reports about strange, anecdotal and unusual things next to information about discoveries and scientifically-proven theories. The representations of a utopian world were among the main subjects of scientific dissemination, besides reports about technological developments or chemical, physical and astronomical phenomena. The reports were often accompanied with illustrations. On many occasions, these representations showed contradictory or impossible scientific processes, being more picturesque than scientific.[75]

Scientific knowledge appeared expressed in other cultural forms, such as literature. Inventions and scientific theories caught the attention of writers, who impregnated their

70 Antonio LAFUENTE – Tiago SARAIVA, *La buena nueva de la ciencia*, in: Antonio Lafuente – Tieago Saraiva (eds.), Imágenes de la ciencia en la España contemporánea, Madrid 1998, pp. 16–27, here p. 20.

71 B. BÉGUET, *La vulgarisation scientifique en France de 1855 à 1914*, p. 8.

72 B. BENSAUDE-VINCENT, *Un public pour la science*, pp. 51–53.

73 A. NIETO-GALÁN, *Los públicos de la ciencia*, pp. 63–65.

74 Florence COLIN, *Les revues de vulgarisarion scientifique*, in: Bruno Béguet (ed.), La science pour tous. Sur la vulgarisation scientifique en France de 1850 à 1914, Paris 1990, pp. 71–9, here pp. 79–80.

75 Bruno BÉGUET, *L'imagerie de la vulgarisation*, in: Bruno Béguet (ed.), La science pour tous. Sur la vulgarisation scientifique en France de 1850 à 1914, Paris 1990, pp. 162–167.

texts with inventions and new scientific discoveries. Scientific concepts found their way into literary texts, and discourses on chemical, physical, biological and medical matters inspired writers, from Mary Shelley's *Frankenstein* to Émile Zola's *Le roman experimental.*[76] In France – and in many other countries of the world where the elites were interested in all things French – the extremely popular novels of Jules Verne brought together the main features and values of scientific literature. Other, less popular authors also knew how to utilise the popularisation of science in their works. I will focus on the writer and illustrator Albert Robida, author of the futuristic trilogy *Le vingtième siècle (1883), La guerre au vingtième siècle (1887)* and *La vie électrique (1890).* These three satirical novels explore and exploit scientific knowledge in order to speculate about the future of the society. Robida was an enthusiast of optical inventions; in his works he depicted the visual play of magic lanterns, microscopy and the telescope.[77] He even created new inventions and machines in his literary and pictorial work, basing it on recent technological and scientific developments.

Robida imagined different machines such as the "photo-phonographe", a hybrid between a magic lantern and a microscope, with a clear reference to visual spectacles such as the above-mentioned show at the Menus-Plaisirs Theatre in 1883. This influence appeared in *La vie électrique*, showing a researcher studying the microbes in a drop of water. This image projects the fascination and fear felt by society towards creatures of the natural world. This fear was morphing into dialogue with the advent of microbiology, including the work of Louis Pasteur and Robert Koch.[78]

Nevertheless, behind the apparent technological utopia, Robida remained sceptical about development without control of scientific knowledge, a terror presented in infernal scenes influenced by the miasma theories popularised in nineteenth-century Europe and beyond.

> "*Les trop grandes agglomérations humaines et l'énorme développement de l'industrie ont amené un assez triste état de choses. Notre atmosphère est souillée et polluée, il faut s'élever dans nos aéronefs à une très grande hauteur pour trouver un air à peu près pur,—vous savez que nous avons encore, à 600 mètres au-dessus du sol, 49,656 microbes et bacilles quelconques par mètre cube d'air.—Nos fleuves charrient de véritables purées des plus dangereux bacilles; dans nos rivières pullulent les ferments pathogènes.*"[79]

76 A. NIETO-GALÁN, *Los públicos de la ciencia*, pp. 73–80.

77 Fleur HOPKINS, *Albert Robida's of future time: the magic lantern turned into a magic mirror*, The Magic Lantern Gazette. A Journal of Research 28, 2016, pp. 3–18.

78 Roy PORTER, *Medical Science*, in: Roy Porter (ed.), The Cambridge Illustrated History of Medicine, Cambridge 1996, pp. 154–201, here p. 184.

79 Albert ROBIDA, *Le vingtième siècle: la vie électrique*, Paris 1892, p. 146.

In these words, Robida expressed fears of wild industrialisation and its consequences on public health. Such a threat was present in the cultural imagination from the beginning of the century, as in the illustration "The March of Break and Mortat" by the cartoonist George Cruikshank. This satirical image, published in the second volume of *Scrap and Sketches* in 1829, presents London invaded by bricks and building tools. The illustrator made references to the urban development that took off in the first decades of the century, an urban transformation that consisted of the construction of huge factories and neighbourhoods characterised by high population density.[80] Far from celebrating the benefits of this radical transformation, Cruikshank represented the problems of this chaotic development in a satirical way. He depicted a battle scene: different anthropomorphic building materials fighting for control of the territory. Not only did he express the aggression of the urban revolution, but he also announced the extinction of nature.[81] Albert Robida followed on from Cruikshank, incorporating into his illustrations the miasma and microbiology theories present in the medical and social debate of the second half of the century.[82]

For Robida, the city of the future was corrupt, the water and air were contaminated by infectious microorganisms. He drew a lugubrious and dark scene with two containers, flask style, in which the consequences of urban illness are observed: the death of every living being. Air pollution is represented as a toxic cloud that reminds us of the visual code of cholera, a non-corporeal infection that surrounds everything.

Le Vigtieme Siècle also represented the progress of microbiology during the last decades of the nineteenth century. From the 1880s onwards, the scientific and medical discourse was able to explain the origin of several infectious diseases; several vaccines were developed and applied, and control over diseases was translated into a more rational and less terrifying image of epidemics. Bacteriology emerged, and medical researchers focused on finding pathogenic germs and ways to combat them.[83] Within this context, Robida imagined a terrible future where the human power over microorganisms was used to cause damage. The French illustrator described a society where scientific experimentation created new pathogens, against which men could not fight. Furthermore, populations clashed in miasmatic wars where chemical battalions bombed the enemy with paralysing gases that produced epileptic attacks.

80 I. MORLEY, *City Chaos, Contagion*, p. 62.

81 Michael RAWSON, *The March of Bricks and Mortar*, Environmental History 17, 2012, pp. 844–851, here p. 848.

82 Maria José BÁGUENA CERVELLERA, *Algunos aspectos de la asimilación de la teoría del contagio animado en la España del siglo XIX*, Cronos: cuadernos valencianos de historia de la medicina y de la ciencia 2, 1999, pp. 285–308.

83 L. URTEAGA, *Miseria, miasmas y microbios*, p. 18.

The terrifying future spawned by an out-of-control experiment is shown in "La Chimie venéneuse, empoisonneuse et sophistiqueuse" [Illustration 12]. This illustration represents a scientist whose head is a flask with crazy features, surrounded by all sorts of laboratory containers and artificially-manufactured food. Once again, monstrosity reflects social fear. Robida's novel of anticipation leads the reader to reflect upon an uncertain future,[84] the pillars of which are based on the benefits of scientific and technological development, but the results of which can be monstrous.

Illustration 12: "La Chimie venéneuse, empoisonneuse et sophistiqueuse" (Albert Robida, 1890; Gutenberg.org)

84 Novels of anticipation are understood as stories framed within the genre of science-fiction, in which the social consequences of scientific and technological advances are described.

Conclusions

Diseases have symptoms that science strives to identify and explain. But together with the symptoms, each pathology generates a reaction in the society that can be manifested through practices and images. Understanding the impact of diseases goes beyond the field of science because the disease is shaped not only by biological factors, but also by socio-cultural ones. This analysis has strived to shed light on the bridge that connects both branches of knowledge.

Diseases have been represented in other ways besides medical description, and these representations should be studied to understand the social impact of these diseases. The satirical illustrations analysed are cultural manifestations of the notion of disease that was circulating in the given society. The response to diseases, particularly infectious diseases, has been changing constantly as society has evolved. In the visual code of the caricatures, we may clearly observe how as soon as scientific knowledge evolved the changes were incorporated into the discourse of the caricaturists.

By focusing on an iconographic analysis, it is possible to detect the codes of representation based on the study of monsters on the one hand, and from the visual code of science on the other. Illustrations depicting beasts and monsters were common during the eighteenth century, but with the naturalisation of monsters the representations that linked illness to supernatural creatures or elements decreased. New monsters appeared, but these were already incorporated into the natural and social system, as nightmares explained by science and not by fantasy or magic.

Another aspect highlighted in this article is the construction of social terror linked to infectious diseases, and how a moral discourse is built around them. We have observed how the ill person is linked to bad social attitudes: from disease understood as an evil ensuing from the devil because of an impure soul during the Middle Ages to the link between poverty and the spread of cholera during the nineteenth century.

The expansion of scientific dissemination shaped the reflection about the present and the future. All publications, exhibitions and scientific debates open to the public provided a basis for thinking about the future from the perspective of the present, all of which promoted scientific speculation and the appearance of works such as Albert Robida's. The publication of these works of anticipation expresses the naturalisation of the scientific discourse in society: despite all the fantastical and imaginary elements represented, the work is no longer framed within the cultural tradition of the fantastical and the supernatural.