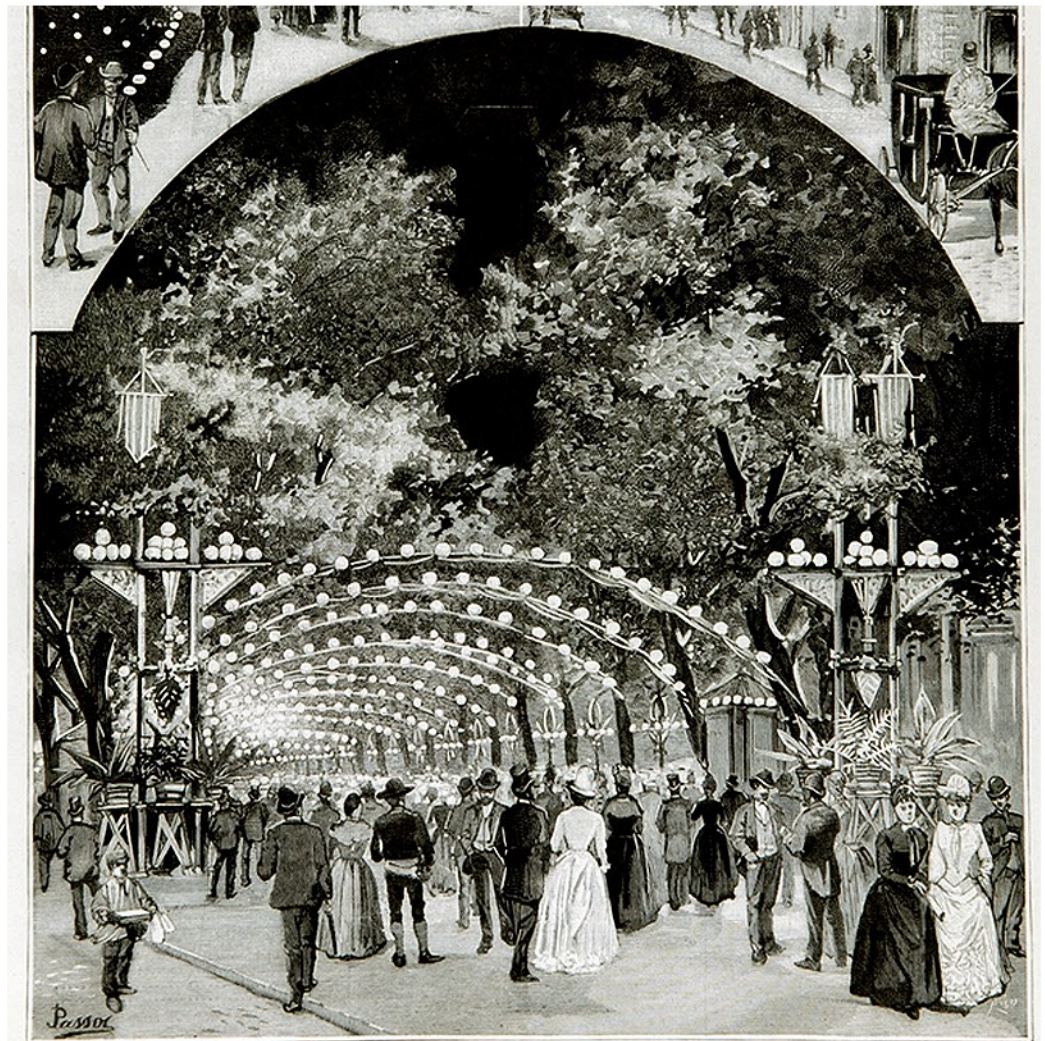
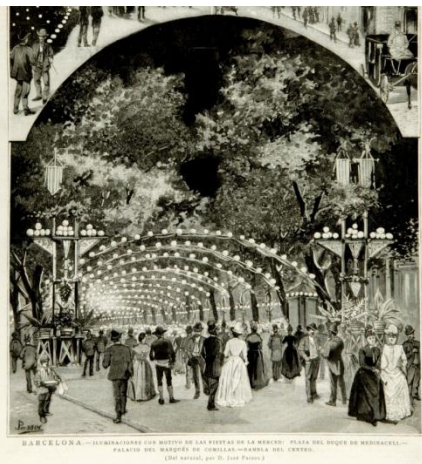


Communicating *Science, Technology and Medicine*



BARCELONA.—ILUMINACIONES CON MOTIVO DE LAS FIESTAS DE LA MERCED: PLAZA DEL DUQUE DE MEDINACELI.—
PALACIO DEL MARQUÉS DE COMILLAS.—RAMBLA DEL CENTRO.
(Del natural, por D. José Passos.)

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Introduction: communicating science, technology and medicine

by Ana Simões*

Popularization of science has already been at the forefront of research among members of the community of historians of science for more than two decades. While the focus was initially on books and periodicals in the Victorian (essentially early 19th to early 20th century) context, other periods, spaces and sources have been progressively taken into consideration.¹ At the same time historiographical revisions have compelled historians to move away from the categories underlying the diffusionist model and their associate meanings, which oppose creative producers to passive recipients and consumers, and contrast the production of knowledge with its transmission.² The vertical model has given way to a horizontal one of circulation and appropriation of science, which gives voice to various actors and to their different, often contradictory, agendas, and conceives science as an active form of communication, in such a way as to ultimately blur the distinction between the making and the communication of science.³

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¹ The literature on this topic is extensive. As merely indicative let me refer to James Secord, *Victorian Sensation. The Extraordinary Publication, Reception and Secret Authorship of Vestiges of the Natural History of Creation* (Chicago: The Chicago University Press, 2000); Jonathan Topham, "Scientific Publishing and the Reading of Science in Nineteenth-Century Britain. A Historiographical Survey and Guide to Sources," *Studies in the History and Philosophy of Science*, 2000, 31A: 559-612; David Knight, *Public Understanding of Science. A History of Communicating Scientific Ideas* (London: Routledge, 2006); Aileen Fyfe, Bernard Lightman, eds., *Science in the Marketplace. Nineteenth-century Sites and Experiences* (Chicago: The Chicago University Press, 2007) for the British context. For the French and Italian contexts see Bernadette Bensaude-Vincent, Anne Rasmussen, eds., *La Science Populaire dans la Presse et l'édition. XIX et XXe. Siècles* (Paris: CNRS, 1997), Paola Govoni, *Un Pubblico per la Scienza. La Divulgazione Scientifica nell'Italia in Formazione* (Roma: Carozzi, 2002). For the European Periphery see Faidra Papanelopoulou, Agustí Nieto-Galan, Enrique Perdiguero, eds., *Popularizing Science and Technology in the European Periphery 1800–2000* (Aldershot: Ashgate, 2009); Josep Simon, Néstor Herran, eds., *Beyond Borders: Fresh Perspectives in History of Science* (Newcastle: Cambridge Scholars, 2008).

² For a description and a critical comment of the diffusionist model regarding popularization of science see Stephen Hilgartner, "The dominant view of popularization: conceptual problems, political issues," *Social Studies of Science*, 1990, 20: 519-39.

³ Concerning historiographical reappraisals see for instance Terry Shinn, Richard Whitley, eds., *Expository Science. Forms and Functions of Popularization* (Dordrecht: Reidel, 1985); Roger Cooter and Stephen Pumfrey, "Separate Spheres and Public Places: Reflections on the History of Science Popularization and Science in Popular Culture", *History of Science*, 1994, 32: 237–267; Bernadette Bensaude-Vincent, *L'Opinion Publique et la Science. A chacun son Ignorance* (Paris: Institut d'Édition Scenofi-Synthélabo, 2000); James A. Secord, "Knowledge in Transit", *Isis*, 2004, 95: 654–672; Kostas Gavroglu, Manolis Patiniotis, Faidra Papanelopoulou, Ana Simões, Ana Carneiro, Maria Paula Diogo, Jose Ramon Bertomeu-Sánchez, Antonio Garcia Belmar, Agustí Nieto-Galan, "Science and technology in the European periphery. Some historiographical reflections", *History of Science* 2008, 46: 153-175; Jonathan Topham, ed., "Focus: Historicizing Popular Science", *Isis*, 2009, 100: 310–368; Agustí Nieto-Galan,

The topic of this HoST issue, dedicated to communicating science, technology and medicine, is in line with the journal's founding aims of striking a balance between local concerns and international trends, interweaving history of science and history of technology (and also in this case history of medicine), and extending the provenance geography of the papers while giving a place to contributions by Portuguese authors.⁴ In fact, articles in this issue address what has formerly been called the popularization of science, broadly conceived in order to encompass also technology and medicine; centre on different (peripheral) contexts, yet circumscribed to the two countries of the Iberian Peninsula, which are not usually the object of mainstream historiography; cover an extended time period, ranging from the 18th to the 20th century; and at the same time, contribute to recent historiographical debates, offering new considerations on the role and functions of the communication of science, technology and medicine. Together with other works focussing on contexts of the European periphery,⁵ this issue hopes to create a momentum that will soon enable to include in scholarly discussions, such as the FOCUS section "Historicizing 'Popular Science'", reflections encompassing perspectives stemming from contexts other than those of the so-called Big Four.⁶

In "A vulgar recreation," the first paper in this HoST issue, José Alberto Silva draws attention to the implications of recent views of science as a communicative enterprise by noting that they ultimately entail linking the emergence of "modern science" in the 17th century to its initial circulatory/communicative modes. These considerations set the stage for a discussion of the multiple functions (scientific text, textbook, popularization book) and the characterization of the typology of readers of the multi-volume work titled *Philosophical Recreation*, authored by the Portuguese Oratorian priest Teodoro de Almeida, which became a best-seller in the Iberian Peninsula and Latin America. It is in this context that the author puts forward the interesting claim that *Philosophical Recreation* should be called a *vulgarization*, instead of a popularization book, contributing in this way to the discussion of how the

Los públicos de la ciencia. Expertos y profanos a través de la historia (Madrid: Fundación Jorge Juan, Marcial Pons Historia, 2011).

⁴ See editorial note of first HoST issue.

⁵ Papanelopoulou et al. *Popularizing Science and Technology in the European Periphery*; Simon, Herran, eds., *Beyond Borders*, and contributions to *Centaurus*, 2009, 51(2), dedicated to science and technology in Spanish, Greek and Danish newspapers around 1900, coordinated by Faidra Papanelopoulou and Peter C. Kjærgaard.

⁶ Despite reference to the perspective of the international group STEP (Science and Technology in the European Periphery) included in Jonathan Topham, "Introduction" to FOCUS "Historicizing 'Popular Science'" (*ISIS*, 2009, 100: 310–18), contributors include exclusively experts in the British, German, French and United States of America contexts.

processes of “popularization” of science should be appropriately named when one deals with periods before the 19th century. The emphasis on *vulgarization* emphasizes that in the context of a highly illiterate population, the readership of that multi-volume book was still restricted to a literate elite (clergy, nobles, the bourgeoisie, state officials, judges, academics, lawyers, teachers, and soldiers) who could afford to buy and read it, and that the use of vernacular languages, Portuguese in this particular case, was the main vehicle to conquer an enlarged—but still far from being popular—audience, which was neither knowledgeable in Latin nor of other European languages, such as French or English, in which many of the books on the new natural philosophy were being written and circulated.

Despite the risks of extrapolation to other contexts and periods, the former conclusion certainly raises a point. When dealing with geographical contexts associated with populations with high rates of illiteracy extending well into the 20th century, historians of science and technology have to constantly reassess the meaning of *popular* when talking about the *popularization* of science, technology and medicine. They should certainly be open to look for other (symbolic or non-symbolic) sources as possible means of communication accessible to illiterate audiences. In such contexts, the habit of oral and multiple readings of newspapers taking place in taverns, barber-shops or cafés, as opposed to individual reading of books and periodicals, or later in time, the practice of listening to the radio, or watching TV programmes, documentaries and films, offer privileged mechanisms for public access to knowledge under stringent communication constraints.

Extreme conditions often call for drastic measures, so these communication scenarios may unveil peculiar strategies and highlight singular trends. These are questions which the three first articles in this issue set out to implicitly or explicitly address. Despite the variety of topics and periods, all contributions draw attention to the (certainly unexpected?) active role played by readers, viewers and consumers, as well as the role of controversy and debate in contexts as different as mid-18th century Lisbon, late 19th-century Barcelona, and Spain in 1930s and 1940s, as seen through the lens of libertarian movements and Franco’s regime, respectively. Additionally, some authors manage to tie the discussion of communication processes and strategies with recent fields such as the urban history of science and science under dictatorship.⁷

⁷ For urban history of science see Sven Dierig, Jens Lachmund, J. Andrew Mendelshon, eds., *Science and the city*, *OSIRIS* 18 (2003), and references therein. Despite an extensive bibliography on science and fascism, the intersection of popularization and fascism is still to be explored.

In “Scientific ‘marvels’ in the public sphere: Barcelona and its 1888 International Exhibition”, Agustí Nieto-Galan places the 1888 Barcelona International Exhibition in the broader context of urban history of science by claiming that this singular event should be envisaged as a manifestation of the city as a whole. It is within this methodological framework that various instances of the communication of science, technology and medicine are discussed, from the public fasting experiments of Giovanni Succi, to the technological failure embodied in captive ballooning, the amusing shows of electric and optical wonders, in which various panoramas played central stage; finally the exhibition of live animals, including exotic ones, displayed in several places throughout the city. In every case, public debate arose and contradictory opinions were expressed regarding the confrontation between traditional and alternative views of medicine, the scientific status of experiments, the impact of technological failures, and the role played by science, technology and medicine as tools in political debates concerning the pros and cons of the exhibition, as well as the associated discussion over the ways in which this complex event revealed the progressive or backward character of the city of Barcelona when contrasted to London, Paris, Vienna or Chicago. The communication of science, broadly conceived to encompass also technology and medicine, played, as usual, multiple functions, from entertainment to education and research, but contrary to the norm in other important cities, experiments were used to question the authority of local science and the status of local scientists.

In “Scientific-medical knowledge management through media communication practices: a review of two opposite models in early 20th century Spain”, Carlos Taberner, Isabel Jiménez-Lucena, and Jorge Molero-Mesa build on their former research in order to compare the multilayered uses of communication of science, technology and medicine and their implications for the role of non-expert participants vis-à-vis experts in such antagonistic contexts as the anarcho-syndicalist press and documentaries associated with Franco’s regime. Their comparative exercise also builds on the methodological premise that if science is presently considered as both practice and *communication*, mass media should concomitantly be viewed as both communication and *practice*. On the one hand, news on medicine and health published in libertarian newspapers and periodicals discussed the role of experts versus non-experts, putting into evidence the participation of non-experts (readers in Q & A sections in the periodical *Estudios*, to give one example), criticized hegemonic forms of knowledge, the control imposed by traditional networks of experts, and

discussed how common people could produce “true” (popular) science in such a way as to contribute to the emancipating role of the working class. On the other hand, the various documentaries on colonial medicine-health issues conveyed a vertical view of communication, clearly separating experts from non-experts, and contributing to the enforcement of an uncritical view towards the regime-reinforcing power relations already established by other means. In addition, both case studies highlight the ideological role of education, one of the multiple functions often played by popularization, as well as the power of knowledge as a privileged means for social transformation.

By seriously taking into consideration the role of the political context in shaping communication strategies, the first three papers in this issue emphasize how the communication of science, technology and medicine serves precise political functions. At times appropriated by social groups, political parties, or even regimes, its propagandistic style is often assumed as part of the ideological message to be conveyed. One can therefore claim that there is often (if not always) a strong ideological basis in the communication of scientific, technological and medical knowledge, which is often bypassed or underrepresented in historical literature when it should be taken much more seriously. This is precisely the focus of the last article in this HoST issue.

In “Science popularization, hegemonic ideology and commercialized science”, Kostas Gavroglu calls attention to the oft-forgotten, or easily dismissed, ideological dimension of the popularization of science, going as far as claiming that if there is anything which closely accompanies the circulation of science, technology and medicine, then that very thing is ideology. According to the author, all instances of popularization of science serve a hidden agenda that should always be taken seriously in historical discussions. Popularization of science becomes a fundamental means to propagate and strengthen ideologies. This is broadly conceived as shared worldviews established by various means, in such a way as to become a tool for social groups, cities, regimes and empires to impose their agendas, as the former three articles have shown, or as a means to assert the reduction of human and societal complexity to simple mathematical modelling by the reinvented scientific imperialism of the hard sciences over the social sciences, as Kostas Gavroglu emphasises. Additionally, popularization contributes to the formulation and imposition of scientific utopias, ranging from the belief in cheap and limitless sources of energy to a global disease-free society; and finally, it helps to reinforce hegemonic values and discourses.

The final question I want to raise is indeed a vexing one: what is genuinely *peripheral* in the discussion offered in this issue, and how are we able to deepen mainstream literature by exploring this historiographical approach? No one doubts that the historical literature has been enriched by new case-studies and the consideration of new historical sources. However, beyond this straightforward claim, what can we find in communicating science, technology and medicine in peripheral regions that we would not find in other contexts? It seems to me that one distinctive characteristic is, first and foremost, the status and authority of science and scientists, which is often taken for granted in non-peripheral contexts, but pervades in discussions insistently in peripheral scenarios, often in relation to the rhetoric of modernization and of progress. This was the case with the controversies surrounding the writings, lectures and shows on the new natural philosophy produced by Teodoro de Almeida and those following his Opening Address at the Academy of Sciences of Lisbon, or the various controversies surrounding scientific, technological and medical aspects, and especially the fasting experiments and performances that took place at the International Exhibition of Barcelona. Therefore, it is the legitimization of science, its association with the building of a nation's identity, and the development and progress of places, cities, regions and countries, often considered as backward, that emerges as one of the distinguishing features of science, technology and medicine communication in the *periphery*. This is certainly a major and intriguing question, which needs to be further explored in case studies involving more research on local peripheral practitioners, popularizers and audiences.

A vulgar *Recreation*

José Alberto Silva *

Abstract

Historical studies on public access to knowledge have been dominantly produced under the banner of “popularization of science”. Case studies on peripheral contexts can eventually disturb that unanimous bias, introducing a fresh approach in the way knowledge is accessed by a different but not necessarily wider audience. This case study focuses on *Philosophical Recreation*, a dialogue on natural philosophy for people who could not attend classes, written by the Oratorian priest Teodoro de Almeida (1722-1804). The essay suggests the expression “vulgarization” instead of “popularization” to clarify the way in which science was accessed in a peripheral context such as eighteenth-century Portugal.

Keywords: Popularization, public knowledge, vulgarization, peripheral context.

In the eighteenth century, natural philosophy encompassed a vast area of knowledge, practices and rhetoric about nature the boundaries of which were always somehow fluid and hardly unanimous.¹

Terms such as “physics”, “experimental philosophy”, “natural philosophy”, and “experimental physics” were usually used to describe a common body of knowledge about nature that nowadays we do include in scientific and engineering subjects such as mechanics, optics, electricity, hydrostatics or chemistry. It is always useful to emphasize that when we are talking about science or scientists in the eighteenth century, we are talking about something that was not recognised as such at that time, using expressions to refer to something that does not exist today, in the 21st century, namely natural philosophy.

It is a territory of variable geometry; it can even be said that there are several kinds of natural philosophy, which are relatable to particular ways of reasoning,

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¹ Simon Schaffer, “Natural Philosophy”, in G. S. Rousseau & Roy Porter (eds), *The Ferment of Knowledge* (Cambridge: Cambridge University press, 1980), pp. 55–91; John Gascoigne, “Ideas of Nature: Natural Philosophy”, in Roy Porter (ed.), *The Cambridge History of Science – Eighteenth-Century Science*, vol. 4 (Cambridge: Cambridge University Press, 2003), pp. 285–304.

practices and material means. The introduction of the concept of the public sphere comprised one of the major tools of analysis to understand the configuration processes of scientific knowledge in the eighteenth century.² However, the mechanisms of public access to natural knowledge in the eighteenth century have not been given as much attention, by historians of science, as that devoted to the processes and practices of science popularization in the nineteenth and twentieth centuries. The umbrella “science popularization” regarding the nineteenth and twentieth centuries does not fit the eighteenth century—at least the Portuguese eighteenth century — thus requiring a redefinition of terms used to characterize science as a public enterprise.

The case study developed here is a contribution to clarify some processes associated with public access to knowledge, in Portugal in the second half of the eighteenth century.

In 1751, the first two volumes of a ten-volume work usually designated as the *Philosophical Recreation, or Dialogue on Natural Philosophy, for the instruction of curious people who could not attend classes* (PR) (Figure 1), written by the Oratorian priest Teodoro de Almeida (1722–1804), were published in Portugal. To call it a “scientific book”, “textbook” or “book of dissemination of science” would imply establishing a demarcation that takes into account the factors of the context in which it was published. Popularization or vulgarization? Which is the most appropriate term to account for the place, the discourse, the practices and audiences assembled in this eighteenth-century text?

Addressing some of these issues will thus consist of describing the content of the PR, knowing how natural philosophy emerges in *it*, who was its real audience, and who read it.

1. Vulgar or popular?

The history of science popularization has been the subject of scrutiny by the latest historiography of science.³ Those proposals are all unanimous in criticizing the diffusionist model of science popularization based on an artificial distinction between the making and communication of knowledge.⁴

² Thomas Broman, “The Habermasian Public Sphere and “Science in the Enlightenment”, *History of Science*, XXXVI (1998), 123–149.

³ The literature on the subject is extensive. I confine myself here to mention the two most recent contributions: Jonathan Topham (org.), “Focus: Historicizing Popular Science”, *Isis*, 100 2 (2009), 310–368 and Faidra Papneloupoulou, Augustí Nieto-Galan and Henrique Perdiguero (eds), *Popularizing Science and Technology in the European Periphery 1800–2000* (Aldershot: Ashgate, 2009).

⁴ Jonathan R. Topham, “Introduction”, *Isis* 100 (2009), 318.

Following a trend theorized by James Secord in “Knowledge in transit”, Jonathan Topham resumes and develops the idea that science popularization—and related concepts such as “popular science” or “public science”—becomes part of the larger territory of science, seen as an “active form of communication.”⁵ This new umbrella in the history of science would include a more organic and articulated relationship between the making and communication of science, a historicization of the concept of popularization and a reformulation of the concept of history of popularization, now envisaged as history of “public knowledge” in a broad sense.

The study of practices, materials, actors and means of science popularization in peripherals and central contexts, carried out by some researchers of the group STEP (Science and Technology in the European Periphery) have added new perspectives to approach this field. These show not only the structuring character of popularization as a process of appropriation of science and technology in peripheral contexts but also the need to adopt comparative methodologies, which allow the mapping of routes of circulation of knowledge between centres and peripheries.⁶

Secord-Topham’s proposal of considering science as an active form of communication implies the matching of the emergence of science communication processes with that of “modern science” itself and, in this case, to consider the seventeenth century as the primary time of popularization. This logical step is precisely rejected—implicitly or explicitly—by historians of science. Science communication processes have had as many configurations as science, in the broadest sense, throughout their history. Therefore, as an alternative to “popularization” or “popular science”, other labels as “public science”, “polite science” or “public knowledge” have been used to designate discourses and practices of science construction as a public enterprise in Europe, in the seventeenth and eighteenth centuries. In the English case, Topham argues that “it makes no sense to speak of

⁵ James A. Secord, “Knowledge in Transit”, *Isis*, 95 (2004), 654–672. In truth, the first historiographical consistent reflection on the history of science popularization questioning the separation between the making and communication of science was made by Roger Cooter and Stephen Pumfrey, “Separate Spheres and Public Places: Reflections on the History of Science Popularization and Science in Popular Culture”, *History of Science*, xxxii (1994), 237–267.

⁶ Agustí Nieto-Galan and Faidra Papanelopoulou, “Science, Technology, and the Public in the European Periphery: A Report of the Fifth STEP meeting (1 – 3 June 2006, Mahon, Minorca)”, *Journal of Science Communication*, 2006, 5 (4), 1 – 5; Faidra Papanelopoulou, et al, op. cit (6); Josep Simon and Néstor Herran (eds.), *Beyond Borders: Fresh Perspectives in History of Science* (Newcastle: Cambridge Scholars, 2008).

“popular science” in Britain before 1800”,⁷ thus reserving the designations “science popularization” and “popular science” for subsequent periods.⁸

This distinction becomes even clearer when complemented with one concerning the use of different linguistic designations related to different contexts of dissemination of science in the eighteenth century.⁹

In the current Portuguese context, “popularização” (popularization), “divulgação” (disclosure) and “vulgarização” (vulgarization) share the same semantic field; the last two even have a common Latin etymological root: *vulgus*, a noun meaning people, crowd; and *vulgo*, a verb that can mean to publish, to disclose, to offer to everyone, etc.¹⁰ In the early eighteenth century, the *Portuguese and Latin Vocabulary (Vocabulario Portuguez e Latino, 1720)* by Rafael Bluteau gives the same semantic field to “vulgo” (common people) and “povo” (people); according to this author, “vulgar” (vulgar) is what we say about the “names, and language that is not Latin and that the common people speak” and “vulgarizar” (to vulgarize), which means to reduce to the popular state, turning something noble into something common and vulgar. And still according to the same dictionary, “divulgar” (to disclose) means “to set abroad; to publish, to make known to everyone”.¹¹ In the transition from the eighteenth to the nineteenth century, the dictionary of Antonio de Moraes Silva adds to the possible meanings of “vulgarisar” (to vulgarise): “divulgar” (to disclosure), “traduzir em vulgar” (to translate into vulgar), “publicar a todos” (to publish to everyone).¹² In none of these dictionaries; however, can we find words like “popularizar” (to popularize) or “popularização” (popularization); and the word “popular” (popular) is defined as “*cousa do povo*” (thing of the people) or referring to “*estilo de pregador*” (preacher style)” or to “*modo de falar próprio da plebe*” (the way of speaking of the plebs).¹³

⁷ Topham, “Introduction”, p. 316.

⁸ Ralph O’Connor assigns to “popular science” a broader sense embracing “science popularization” Thus “popular science” refers to “science of or for the people” whereas “science popularization” refers to the science produced by an elite and aimed at a wider audience outside this elite (Ralph O’Connor, “Reflections on Popular Science in Britain”, *Isis*, 100, 2 (2009), 340 – 343).

⁹ With reference to the semantic tribulations of the term “popular science” in the Anglophone context as well as the contributions, in this field, of Bernardette Bensaude-Vincent for the French context, please see Jonathan Topham, “Rethinking the History of Science Popularization / Popular Science”, in Faidra Papaneloupoulou et al. (eds), *Popularizing Science*, pp. 6 – 11.

¹⁰ *Dicionário de Latim Português*, 2nd edition (Porto: Porto Editora, 2001), p. 714.

¹¹ Rafael Bluteau, *Vocabulario Portuguez e Latino* (Coimbra: Real Collegio das Artes da Companhia de Jesus, 1713), p. 268.

¹² António de Moraes Silva, *Dicionario da Lingua Portuguesa*, 2nd edition (Lisbon: Na Typographia Lacerdina, 1813), p. 631.

¹³ Bluteau, *Vocabulario Portuguez* (Lisbon: Na Oficinas de Pascoal da Sylva, 1720), p.706.

Some of these words, beyond their mere denotative function, also have a strong social mark, and even moral; “vulgo” (common people) could be used as opposed to noble or honourable, and “vulgarizar” (to vulgarize) according to Moraes, could also mean either a decrease of the social status or the prostitution of the body.¹⁴ This brief excursion into the eighteenth-century lexicon allows glancing at some characteristics of the configuration processes of science in that century. Access to knowledge by a wider social group meant the widening of the area of distribution and the increase of the circulation circuits of natural knowledge. This new configuration implied that the literary communication of said knowledge also be made – in addition to Latin – in the local language, namely, it would imply the vulgarization of knowledge, “to publish, to make known to everyone”, “to translate into vulgar, to publish to all”. In this context, “vulgo” (common people) is not yet “povo popular” (popular people), but which only began to be established in the nineteenth century, and simply, for the people who can read in the vernacular. This cultural evidence, the degree of illiteracy of the place, turns science vulgarization into a process marked by the social nature of the audience involved. It is inseparable, as we will see in the case of the *PR*, from the practices and rhetoric of science vulgarization of that time.

2. *Philosophical Recreation, a vulgarization machine*

Teodoro de Almeida was born in Lisbon on 7 January 1722, entering the Oratorian Congregation at the age of thirteen. After one year of novitiate according to the Oratorian custom, he spent three years studying philosophy followed by four years in theology. Almeida studied natural philosophy with Father João Baptista. At the age of 26 he was appointed Master Professor of philosophy at the College of the Congregation.

In 1751, the same year that Denis Diderot and Jean d’Alembert published the first of the twenty-eight volumes of *L’Encyclopédie*, the first two volumes of Almeida’s *PR* were published in Lisbon. Its purpose was clearly stated by Teodoro de Almeida from its very beginning. In the subtitle he made explicit reference to a “Dialogue on Natural Philosophy for the instruction of curious people who could not attend classes” and, in the Dedication to King José I, Almeida claimed to be writing “not for those who are educated in deep learning, but for those that, by lack of books

¹⁴ “Vulgarizar o corpo”, ou seja, devassa-lo, prostituí-lo, como na frase “mulher que se vulgarizava ao primeiro que chegasse” (Moraes, *Diccionario da Lingua Portugeza*, 2ª edição, p. 537).

written in their mother tongue, live without instruction”.¹⁵ The Dedication also included a diagnosis of the Portuguese cultural context of the time:¹⁶

I see that the wonders of nature are hidden from people; I see that an ugly avarice prevents those wonders from coming to light in the classrooms; I see that many noble and witted men live yet in a vile submission, following and revering ancient errors, and that they adore respectfully the shade because they have not seen yet the light.

The first volume (1751) discussed properties of motion, gravity and phenomena related to liquids. The second (1751) dealt with properties related to the senses—light, colour, heat, cold, smell, taste and flavour—and included a contrast between Moderns and Ancients, namely, concerning “Eucharistic Accidents” and “The Soul of Beasts”. The third volume (1752) dealt with the four Aristotelians elements—Earth, Fire, Water, Air—and the weight of air. The fourth (1757), subtitled *About man*, dealt with dioptrics, catoptrics, and “the other senses of man”, as well as “The Fabric of the Human Body”. The fifth volume (1761) was subtitled *About beasts and plants*, and the sixth “and last” volume (1762) was subtitled *About heavens and the world*.

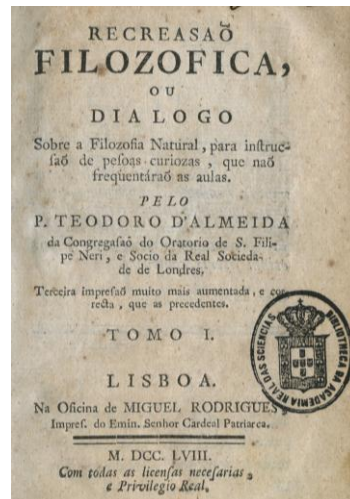


Figure 1 - Title page of Teodoro de Almeida’s *Philosophical Recreation*, Volume I, 3rd edition, 1763 (Library of the Academy of Sciences of Lisbon).

¹⁵ Teodoro de Almeida, *Recreação philosophica ou Dialogo sobre a filosofia racional para instrução de pessoas curiosas que não frequentarão as aulas*, I, 4th edn (Lisbon: Na Regia Officina Typografica, 1778), Dedication, pp. vii, ix. See, on Teodoro de Almeida and the appropriation of natural philosophy in eighteenth-century Portugal, José Alberto Silva, “The Portuguese popularizer of science Teodoro de Almeida: agendas, publics, and bilingualism”, *History of Science* 1 (2012), 93 – 122.

¹⁶ *Ibid*, pp. vi, vii.

Twenty-four years elapsed between the printing of vol. VII and that of vol. VIII, *Dialogue on metaphysics*, released in 1792. Then vol. IX, in 1793, was entitled *Natural theology or Harmony of reason and religion, or Philosophical answers to the arguments of unbelievers*, and vol. X, *Philosophical recreation about moral philosophy*, appeared in 1800.¹⁷ The first nine of those twenty-four years (1768–77), Almeida spent in exile, first in Spain and then in France, as a result of his opposition to the absolutist policy of the Marquis of Pombal, Prime-minister of King José I. Almeida returned to Portugal, in 1777, after the King's death and the dismissal of the Marquis of Pombal by Queen Maria I.¹⁸ In France, at Bayonne and Auch, Almeida had lectured on experimental philosophy and built instruments, while performing his pastoral duties as a priest.¹⁹

In his volumes Almeida criticized Aristotelian–Scholastic philosophy, advocating the use of modern philosophy, i.e., a mechanical explanation of natural phenomena based on experiment, which included, for example, the defence of atomism, the existence of a void, the weight of the air, the heliocentric view, and the Newtonian gravitational system.

A quick statistical survey conducted on the *PR*, shows the relative importance of the different topics covered in the work:

Topics	Pages	Afternoons ²⁰	Volume
1. Mechanics Kinematics, collisions, composition of movements Machines	240 (10.5%)	3	1
2. Hydrostatics	100 (4%)	1	1

¹⁷ Almeida wrote other works, mostly of a religious and moral nature. *One of them was The Happy Man, independent of fortune and of the world* (O feliz independente do mundo e da fortuna) (1779), a moral novel inspired in *Les aventures de Télémaque* by the French theologian François Fénelon, which became another best-seller in the Iberian Peninsula with 26 editions in Spanish (1779–1884) (See Zulmira C. Santos, “*Literatura e espiritualidade na obra de Teodoro de Almeida (1722–1804)*” (Lisbon: Fundação Calouste Gulbenkian / FCT, 2007), pp. 336 - 366).

¹⁸ For details on the banishment and exile of Teodoro de Almeida and other Oratorians see A. A. Banha de Andrade, *Contributos para a história da mentalidade pedagógica Portuguesa* (Lisbon: Imprensa Nacional/Casa da Moeda, 1982), 419 – 433.

¹⁹ During his exile in France Almeida exchanged letters with Francisco Sanches, asking for medical advice, and telling him about the machines he was building, his writings, and other incidents of his daily life. The letters were transcribed in Maria Leopoldina Azevedo, “P. Teodoro de Almeida, subsídios para o estudo da sua vida e obra”, B.A. diss. (Coimbra: Faculdade de Letras da Universidade de Coimbra, 1959, pp. 278–370).

²⁰ Dialogues were taken in the “afternoons” at Almeida’s house or rambling outdoors.

3. Fire			
Nature of fire	178	3	II & III
Subterranean fires			
Fireworks	(7.8%)		
Gunpowder			
Heat			
4. Water			
	60	1	III
	(2.6%)		
5. Air			
Air weight and spring	170	2,5	III
Pneumatic machine	(7.4%)		
6. Light			
Properties, reflection and refraction. Diffraction.	290		
Colours: Newtonian system.	(12,7%)	5	II & IV
The eye Lenses and mirrors			
7. Sound			
Nature and Propagation. Echo	40	1/2	II
	(1,8%)		
8. Smell, taste and cold			
	52	1	II
	(2.3%)		
9. Eucharistic accidents			
The Soul of Beasts	102	1	II
	(4.5%)		
10. The Man			
Senses, anatomy, blood, organs.	178	3	IV
	(7.8%)		
11. The Beasts and Plants			
Soul, memory sensation and generation.	393		
Insects, Birds, Fish, Shellfish and Land animals	(17.2%)	6	V
12. Heavens and the world (Astronomy)			
	480	5	VI
	(21%)		

Table 1 - Topics covered by Teodoro de Almeida's *Philosophical Recreation*.

Besides a thematic coincidence with similar works by other authors, Almeida's is a more extensive approach to natural philosophy, as shown by the inclusion of subjects of natural history. Still some topics were left out of the *PR*, as electricity or magnetism, which, however, were later to be included in the *Cartas Físico-Matemáticas (Physical-Mathematical Letters)*.²¹

Although dialogue was the literary genre chosen for all volumes of the *PR*, characters changed throughout the ten volumes. In the first eight volumes, the

²¹ Teodoro de Almeida, *Cartas Físico-Matemáticas para servir de Supplemento à Recreação Filosófica*, Tomo I – Sobre os Elementos de Geometria (Lisbon: Na Oficina de Rodrigues Galhardo, 1784); Idem, Tomo II – Sobre a Mecânica ou Leis de Movimento (Lisbon: Na Oficina de Rodrigues Galhardo, 1784); Idem, Tomo III (Lisbon: Na Regia Oficina Typografica, 1799).

dialogue involved three characters: Teodósio, an advocate of the Moderns and Almeida's alter ego; Sílvio, an Aristotelian physician who had graduated in Medicine at the University of Coimbra and was an advocate of scholasticism; and Eugenio, a military man conducting business in Court and an apprentice of modern philosophy. In the first eight volumes the dialogues took place mainly at Teodósio's house, where experiments were staged, or else while the interlocutors were rambling outdoors.

The "light of reason" and "experiment"—or "strokes of experiment"—are the rhetorical devices around which Almeida articulated his discourse on natural philosophy. The different themes of natural philosophy are presented under the motto "instructing by recreation" and supported by rhetoric of persuasion based on a dialogue and by resorting to experimental evidence, described or graphically presented in the engravings placed at the end of each volume, or cited from other sources.

In Almeida's discourse, "reason" emerges as a pervasive methodological precondition, operating on two levels. One is generically understood as a search for the truth the final purpose of which is to penetrate the core of both creatures and natural phenomena and in this way to unveil the vestiges of God's wisdom, the signs of which the wise Author of the world had imprinted on it. Almeida punctuates frequently his dialogue with this reason of the ultimate purposes, which is but design elevated to the category of the world's organizing principle. At another level, it is an operational and instrumental category. It is the kind of reason that structures the explanatory scheme of natural phenomena by using a deductive and geometric reasoning, which, according to Almeida, is independent from questions of faith.²²

The use of experiment is another methodological instance to which Almeida resorts throughout his dialogue on natural philosophy. Experiments are interwoven in his discourse making his arguments more solid. He conducts and describes some of these experiments; other experiments are purely conceptual and in this case Almeida illustrates them with drawings that he describes, by placing them in the engravings at the end of each volume (Fig. 1). Finally, he also uses experiments mentioned in texts written by foreign authors, whom he cites in order to reinforce his arguments. When experiments could not be performed, Teodósio's arguments were supported by several plates and descriptions of experiments selected from periodicals written in French such as *Journal des Sçavans*, *Mémoires de Trevoux*, and *Mémoires de l'Académie*,

²² Almeida, *PR*, VI (1762), p. 280.

as well as books including those of Stephen Hales (1677 – 1761), Jean-Antoine Nollet (1700–1770), Noel Regnault (1683–1762), Petrus van Musschenbroek (1692 – 1761), Willem Jacobs’s Gravesande (1688 – 1742) and J. T. Desaguliers (1683 – 1744), Newton (1643 – 1727), Buffon (1707 – 1788), Voltaire (1694 – 1778), William Derham (1657 – 1735) and Jan Swammerdam (1637 – 1680). Each volume ended with an “Index of the most remarkable things” and several plates illustrating most of the experiments reported in the text.

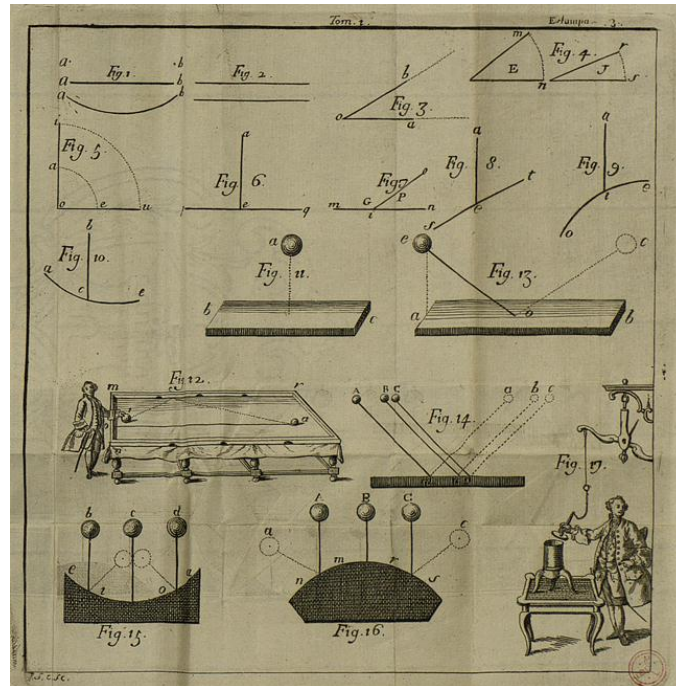


Figure 2 - Geometry and some laws of motion (PR, I, Plate 3). Figure 17 (bottom right of the plate) refers to weight of liquids.

The six volumes devoted to natural philosophy covered a variety of topics (see Table 1). From this list of topics it is easy to conclude that the purpose of the *PR* extended beyond natural philosophy, by addressing subjects that were considered to be part of natural history, such as descriptions of insects, fish and birds and even of some geological phenomena.

In the last two volumes of the *PR*, the context changed and the number of characters increases. Here he focuses on natural theology and moral philosophy; the opposing theses being those of the philosophers Diderot, Voltaire and Rousseau, presenting a number of characters with whom Teodósio, Almeida’s alter ego, and the fictional Baroness of Armendariz exchange arguments. The military and rural aristocracy—guests and visitors of the baroness’s house—shape the human landscape of the *PR*: a “Chevalier Sansfond”, an atheist colonel, a Protestant major, a baron, a

count, a marchioness, aunt to the baroness and play writer, and a commander, confront the views of the *philosophes* by resorting to “healthy philosophy,” which endorsed “Divine Religion” against the “unbelievers,” as advocated by Teodósio.²³

The program undertaken by Almeida to instruct those who could not attend classes, in other words with no secondary education, led him to avoid, although not completely, the introduction of mathematics in the *PR*. The nature of the subjects that he addresses such as, for example, the composition of motions, levers, hydrostatics or the relation between forces and speeds, makes him resort to arguments of the geometric nature included in the prints of the book. There were situations, however, in which he could not avoid the use of mathematics, as in the case of the Kepler's laws, the law of gravitational attraction, the determination of the mass of the planets, or the Newtonian theory of tides covered in the *PR*'s Volume VI.²⁴

3. The reaction of his contemporaries

The publication of the *PR* was devilled with controversy from the very beginning. One of the disagreements revolved around themes that today one could no longer consider marginal to the scientific paradigm but which, in the eighteenth century, were still part of the corpus of natural philosophy, due to their relationship with religion: the existence or not of a soul in beasts and the Eucharistic accidents. Is not the place here to develop this line of controversy but merely to mention that Almeida defended in the *PR* a line of argument close to the Cartesian *doxa*: beasts have no soul, or at least not the same as humans; as regards the Eucharist, Almeida claimed that accidents are not entities distinct from substance, as defended by the advocates of scholasticism; and as such, as form was not an entity distinct from matter but the way matter presents itself, it is thanks to the miraculous divine intervention that the bread and the wine—when they become, in the Eucharist, the body and blood of Christ—retain their characteristics, such as taste or smell.²⁵

The other line of controversy involved experimental philosophy and the way it was conveyed in the *PR* in opposition to a qualitative, speculative and inclusive approach of natural phenomena hitherto practiced in colleges and universities, known as “ancient philosophy” or “peripatetic philosophy.” Conversely, Almeida

²³ Almeida, *PR*, IX (1793), “Dedicatória”, pp. 7, 8.

²⁴ In the latter case, the cause of tides, Almeida not only proposes its own theory, even more complete than the one proposed by the Newtonian doctrine, but he constructs a tool intended to prove his theory.

²⁵ Almeida, *PR*, I, p. 308.

defends an approach to the natural phenomena of nature based on experiment and the use of mathematics as an analytical instrument.

One of the argumentative strategies of the staunchest opponents to modern philosophy and, namely, of the *PR*, consisted of its depreciation and philosophical downgrading by relegating it to a mere text to be used in schools that taught children how to read and, at the same time, philosophise.²⁶ There were two distinct arguments to temper this controversy: one was the use of the vernacular, or vulgar, instead of Latin; the other concerned the public nature of lectures on experimental philosophy, which were inaugurated in 1751 in one of the colleges of the Oratorians in Lisbon, *Casa das Necessidades*, by Father João Baptista, and then continued by Teodoro de Almeida. One of the staunchest critics of Almeida was the Jesuit Paulo Amaro who criticized the public lectures on experimental physics delivered by Almeida in the *Casa das Necessidades*: “what was practiced there was a deception of simple idiots who considered that to be a Physicist was as easy as to visit two exhibitions, which, without any science of Physics, are shown in some cities of France and Italy, simple Machinists.”²⁷ He added ‘that there [at *Casa das Necessidades*] Science was almost prostituted, as it was communicated to many people who were even deprived of the rudiments of the Latin language.”²⁸

In addition to epistemological arguments, Almeida’s critics directly related these new practices of public access to knowledge to the social status of their attenders. On the frontispiece of another printed text, which criticises the theses defended in *the PR*, one reads, anonymously, that the *PR* is a “very useful work for the present century, since even maids, and simple barefoot women, pride themselves of knowing much philosophy.”²⁹

A criticism of a different nature was the accusation of plagiarism against the *PR*. This accusation has to be understood in the light of the Portuguese context of the time. It began right after the publication of the first two volumes, became recurrent

²⁶ This is the argumentation presented by Philiarco Pherepono, *Mercurio Philosophico dirigido aos Philosophos de Portugal* (Augusta: Veith Martin, 1752), p. 44-45. This text, signed with a pseudonym, is assigned to the Jesuit Paulo Amaro (1695-1754/8), professor of rhetoric at the College of the Arts (See Francisco Contente Domingues, *Ilustração e Catolicismo: Teodoro de Almeida* (Lisbon: Colibri Editions, 1994) pp. 53, 77-78).

²⁷ The original reads: “que o que ali se praticava era hum engano de simplicis idiotas, que cuidavão, que o ser Physico custava tão pouco, como o ver huas exibiçoens, que, sem sciencia algua da Physica, ostentaõ em algumas Cidades de França e Itália, huns puros Maquinistas.” Paulo Amaro, *Idem*, p. 8.

²⁸ The original reads: “que ali [Casa das Necessidades] quasi se prostituía a Ciência, comunicando-a a muitos, que se achavam destituídos ate dos primeiros rudimentos da língua latina.” *Ibidem*, p. 7

²⁹ The original reads: “obra utilíssima para o século presente, em que athe as creadas de escada abaixo, e as mulheres de pé descalço, cântaro, e rio, etc., se prezão de saber muita Philosophia.” Famião Ferão Philaethe, *Palinodia Manifesta* (Sevilha: Antonio Bucaferro, 1752).

and was taken up again thirty years later, when the Royal Academy of Sciences of Lisbon was founded, in 1780, Almeida being one of its founders.

Already in 1752, Almeida had been accused of having plagiarized “certain little French books” written in the form of a dialogue and which he had identified, when replying to the accusation, as being *Les Entretiens physiques* authored by the Jesuit priest Noel Regnault.³⁰ A simple comparison between the *PR* and the *Entretiens* shows, however, the abusive character of the accusation. In effect, the similarities end with the themes Almeida dealt with, the format he adopted and the use of dialogue as a literary device. The differences between both works are, indeed, more substantial: a more accentuated and obvious Cartesian character in Regnault rather than in Almeida, in explaining natural phenomena, and a more obvious distance from the Newtonian approach to natural phenomena adopted by the French author.³¹

About fifty years later, the new-born Academy of Sciences of Lisbon, has its inaugural session on 4 July, 1780. Teodoro de Almeida was the selected speaker and his *Oração de abertura (Inaugural Speech)* was surrounded by controversy among his critics and fellow academicians.³² One of the various letters criticizing Almeida’s *Speech* reads: “today who will bother to look at it, when other much more perfect philosophical courses by Gravesande, Muschenbroeck, Nollet, which your Reverend has subserviently plagiarized, are in the hands of the Portuguese?”³³ This time the accusation is even more unreasonable, because not even formally their writings have any resemblance to the *PR*.

In his reply to the accusers, Almeida touches a recurring aspect, which in some way derives from his position as an author of a peripheral country. By pointing out the differences between his *PR* and the *Entretiens*, Almeida argues that the absence of references to scholasticism in the French text is explained by the fact that

³⁰ Teodoro de Almeida, *PR*, III (2nd ed., 1753), pp. 11 – 19.

³¹ José Alberto Silva, *A apropriação da filosofia natural em Teodoro de Almeida (172 – 1804)* (Lisbon: CIUHCT - Centro Interuniversitário de História das Ciências e da Tecnologia, 2009), pp. 38 – 40. In his defence a contemporary, the Jesuit Inácio Monteiro in his *Compendio dos Elementos de Mathematica (1754/1756)* mentioned that the accusation of plagiarism against Almeida’s *PR* was a criticism with “less sincerity and truthfulness than it should have” claiming that “its author benefited his nation with this book” (Inácio Monteiro, *Compendio dos Elementos de Mathematica*, vol. I (Coimbra: Real Colegió das Artes, 1754), pp. 328 – 329, apud Miguel Corrêa Monteiro, Inácio Monteiro (1724-1812). *Um jesuíta português na dispersão* (Lisbon: Centro de História da Universidade de Lisbon, 2004), p. 384).

³² Almeida’s inaugural speech as well as letters criticising it are transcribed in Cristóvão Ayres, *Para a História da Academia das Ciências* (Coimbra: Imprensa da Universidade, 1927), pp. 97 – 121.

³³ “Sátira. Espalhada contra um religioso de S. Filipe Néri por ocasião de uma prática que disse na abertura da Academia das Ciências em Lisbon, 1783”, BNP, ms. 236, n° 20.

“in France people no longer talk about it,” contrary to “our Lisbon, where there are many patrons of scholasticism.”³⁴ Almeida is referring to Portuguese cultural backwardness, which he had already addressed on another occasion, at the end of the “Preliminary Discourse about the History of Philosophy”. From the third edition onwards, it is located at the beginning of volume I of the *PR*: “no wonder the progress of it [philosophy] which will be made by the Portuguese, when daylight although late will dawn on them intense and bright enough to lead them to the knowledge of the truth.”³⁵ He would address this topic again in the inaugural speech of the Academy of Sciences of Lisbon, which stirred harsh criticism towards him.

4. The audience of *Philosophical Recreation*

Criticism of authority, eclecticism, the use of Portuguese instead of Latin and the refusal to tackle metaphysical issues supported the main rhetorical devices used by Almeida:

I will not follow any school; neither will blindly follow any specific Author; but only what, to the best of my knowledge and belief, enables me to reach the truth.... I do not follow the style used in schools since it is less pleasant and less clear; neither do I argue through metaphysical issues used in classes, because my plan is to write to all and not to only a few.... My aim is to enlighten and at the same time entertain my readers.³⁶

The didactic or pedagogical purpose of the *PR* is clear. Many texts of this period, the eighteenth century, which addressed topics of natural philosophy, shared this same goal. The *PR* did not escape the spirit of its time: Regnault, Nollet and Antoine-Noël Pluche (1638–1761) are some of the authors who ornament the reference frame claimed by Almeida in the *PR*. This pedagogic trace is enhanced by Almeida when, to justify the publication of the seventh volume on Logic following the other six volumes on Natural Philosophy, he refers to it as advantageous for the instruction of youth to give first “such a good idea of the study of Physics”³⁷ followed

³⁴ Almeida, *PR*, III, p. 12

³⁵ Almeida, *PR*, I, p. lviii, lix.

³⁶ *Ibid.*, prologue, pp. VII, IX and X.

³⁷ *Cartas*, tomo I, p. 4

by the study of Logic, finding in Physics “good examples of its dictates.”³⁸ Moreover, consistent with his perspective, Almeida would also publish three volumes of *Cartas Físico-Matemáticas (Physical-Mathematical Letters)*, designed to serve as a complement to the *PR*, in which some of the topics addressed in the *PR* are developed in the form of letters.

The *PR* brought together the necessary ingredients to become, as it came to pass, a publishing success. It was a didactic approach to natural philosophy, written in Portuguese and in a peripheral context in which the editorial production of texts on natural philosophy in Portuguese was scarce, not to say non-existent. It corresponded to what is now called, with some understatement, “market needs.” Each volume of the *PR* had at least five or six different editions in Portuguese and several Spanish translations, the last of which dated back to 1873.³⁹ Each volume of the *PR* sold in the library of the Oratorians of the *Casa do Espírito Santo*, was worth 400 réis on paper or 500 réis with a cover⁴⁰. However, in accordance with the standards of that time, that price was not within reach of every pocket.

Latin America was, by way of the translations intended to the Spanish colonial circuit, another area of appropriation of the *PR*. The Jesuit priest and historian Guillermo Furlong (1889–1974) mentioned that Almeida's *Philosophical Recreation* was as popular in the province of Rio de la Plata, Argentina, as the writings of Benito Feijóo (1676–1764), and that there were several texts of natural philosophy written by local authors throughout the eighteenth century, which quoted Almeida, alongside Nollet, the Oratorian Vicente Tosca (1651–1723) and Gravesande, among others.⁴¹ Also in Mexico, the writer Fernandez de Lizardi (1776–1827), in his novel

³⁸ *PR*, tomo X, p. 2.

³⁹ A list of Almeida's books translated into French and Castilian are included in Zulmira C. Santos, op. cit. (17), pp. 433 - 438.

⁴⁰ In comparative terms, in 1733, the daily wage of an apprentice with two years of training ranged between 200 and 240 réis and the one of a workshop master was 600 réis; in 1755, the cost of a pound (459 g) of codfish or rice was about 35 réis (E. F. de Oliveira, *Elementos para a história do município de Lisbon*, volume IX (Lisbon: Tip. Universal, 1882-1943), apud Marie-Hélène Piwnik, *O Anónimo – Journal Portugais du XVIIIème siècle (1752 – 1754)* (Paris: FCG, 1979), p. 88. In Porto, in 1780, a green wine almude was worth 180 réis and a chicken 240 réis; the daily working time of a agricultural laborer was 80 réis e the one of a worker with a yoke of oxen was 250 réis (Vitorino Magalhães Godinho, *prix et Monnaies au Portugal, 1750-1850* (Paris: Armand Colin, 1955), p. 82-84, apud João Luís Lisboa, *Ciência e política: Ler nos finais do Antigo Regime* (Lisbon, 1992, p. 60). The salaries of the 837 teachers and professors created by the law of November 6, 1772 were around 90,000 réis a year in Lisbon and between 40,000 and 60,000 réis in the rest of the country.

⁴¹ Guillermo Furlong, S.J., *Nacymiento e Desarrollo de la Filosofia en el Rio de la Plata, 1536-1810* (Buenos Aires: Guillermo F. Kraft, 1952), pp. 254-255, 271-271, 296, 376, 400. On the translations and Spanish subscribers of Teodoro de Almeida see, of Marie-Hélène Piwnik, “Les souscripteurs espagnols du P. Teodoro de Almeida (1722–1804), *Bulletin des Études Portugaises et Brésiliennes*, (1981), 95 -119 and “Une entreprise lucrative: Les traductions en espagnol du Père Teodoro de Almeida”, Archives of the Portuguese Cultural Center, XXXI (Paris: Fundação Calouste Gulbenkian, 1992), 199 – 206 and Robert Ricard, “Sur la difusion des oeuvres du P. Teodoro de Almeida”, Off-print of the *Boletim InternacionaL de Bibliografia Luso-Brasileira*, IV, 4 (1963), 1-9.

El Periquillo Sarniento, introduces Almeida's *PR*, alongside works by Nollet, or Pluche Bufon, as works that "are useful, entertaining and fun, because the understanding does not find in them the abstract character of theology, the uncertainty of medicine, the intricacies of law, nor the thorniness of mathematics. Everything fulfils, everything delights, and everything captivates and teaches, both in physics and in natural history."⁴²

Another case of circulation of the *PR* is its use in the university context. In Portugal, Giovanni Antonio Dalla Bella (1730–1823), from 1772 professor of experimental physics in the reformed University of Coimbra, used the *PR* as a reference in organizing the Physics Cabinet, by quoting it in the *Instrumentorum Index*.⁴³ Also at the University of São Carlos in Guatemala, the *PR* was used as a manual in the eighteenth century.⁴⁴

Although it was intentionally written for an audience that Almeida characterized as "curious people who could not attend classes," one should envisage this audience as a virtual entity that hardly corresponded to the low level of illiteracy characteristic of the eighteenth-century Portugal. In the absence of a list of the *PR* subscribers, or the number of copies of each volume, it is therefore necessary to resort to indirect evidence such as the number of editions of each volume, the translations, the profile of the audience for similar publications or the price at which each volume of the *PR* was sold. An analysis of the subscribers list of the three most significant periodicals of the time, *Anónimo* (Anonymous) (1752–1754), *Gazeta Literária* (Literary Gazette) (1761–1762) and *Jornal Enciclopédico* (*Encyclopaedic Journal*) (1779–1806), allows us to infer the socio-professional profile of the *PR* readers as being characterized by a literate elite — which includes teachers, clergy, state officials, judges, academics, lawyers, soldiers, nobles, and burghers.⁴⁵

⁴² The original reads: "son útiles, amenos y divertidos; porque el entendimiento no encuentra en ellos lo abstracto de la teología, la incertidumbre de la medicina, lo intrincado de las leyes, ni lo escabroso de las matemáticas. Todo llena, todo deleita, todo embelesa y todo enseña, así en la física como en la historia natural." Fernández de Lizardi, *El Periquillo Sarniento*, tomo I, cap.VIII, 1817, transcription of the 4th edition in http://www.cervantesvirtual.com/obra-visor/el-periquillo-sarniento-tomo-i/html/a40e3bfe-0032-4f4f-8a9e-a38607b7cb08_3.html#12 (10/8/2012).

⁴³ Rómulo de Carvalho, *História do Gabinete de Física da Universidade de Coimbra* (Coimbra: Universidade de Coimbra, 1978), pp. 128 -130

⁴⁴ John Tate Lanning, "The reception of the Enlightenment in Latin America", in Arthur Whitaker, ed., *Latin America and the Enlightenment* (Ithaca: Cornell University press, 1961), p.73.

⁴⁵ For a more detailed discussion see José Alberto Silva, op. cit. (15), 107 – 111. Despite women being absent from these subscribers lists, it does not allow us to exclude them from the group of *PR* readers. In fact, 126 (5%) of a group of 2420 library catalogs, collected by the Royal Censorship (Real Mesa Censória) in 1769/70 all over the country, were owned by women (Maria Adelaide Salvador Marques, *A Real Mesa Censória e a Cultura Nacional*, *Boletim da Biblioteca da Universidade de Coimbra*, XXVI (1964), 83 – 87).

In the Iberian circuit, the translation and dissemination of Teodoro de Almeida's books went beyond the translations of the *PR*. The promotion and subscription of the *Physical-Mathematical Letters* in Spain, was analysed by Marie H el ene Piwnick from the list of subscribers of the *Gazeta de Madrid* (*Madrid Gazette*). The profile of the readers is similar to the formerly presented: nobility (5%), clergy (20%), and then a group of people belonging to a foreign elite of magistrates, physicians and civil servants (85%).⁴⁶

One of the specificities of the *PR* in relation to French and Dutch similar texts has to do with the double linguistic barrier, which Almeida set out to overthrow. This specificity derived from his situation of a peripheral author. It was not Latin, only, but also the ignorance about foreign languages—'French, English German and others'—which, according to Almeida resulted in an obstacle preventing access to natural philosophy, a 'barbarian cruelty', which forced 'those who knew no other language besides their own to be ignorant.'⁴⁷ The vernacular of the *PR* fulfilled the purpose of circumventing the Latin barrier—a common purpose shared by other foreign books also written in the vernacular—but added another, that of circumventing the inaccessibility to part of the Portuguese audience of texts written in foreign languages.

It is not surprising that a multivolume book published over 50 years, encompassing such a multiplicity of topics, has had different receptions throughout this very period. In the Iberian context and of its colonial ramifications it is unique. The absence of publications vulgarizing the natural sciences, in the local language—Portuguese and /or Castilian—made obvious the *PR*'s popularity. A hypothesis to be considered is that in Iberian colonial contexts, the difficult availability of publications popularizing science, in addition to the linguistic barrier, made the *PR*, and to some extent the *Letters*, a vehicle more immediately accessible to the sciences.

5. Conclusion

The processes of access to scientific knowledge by a wider and unskilled audience have usually been labelled "science popularization". In the nineteenth century and

⁴⁶ About the translations and Spanish subscribers of Teodoro de Almeida see Marie-H el ene Piwnick, "Les souscripteurs espagnols du P. Teodoro de Almeida (1722 – 1804)", *Bulletin des  tudes Portugaises et Br siliennes*, 42 (1981), 95 -119 e "Une entreprise lucrative: Les traductions en espagnol du P re Teodoro de Almeida", *Arquivos do Centro Cultural Portugu s*, XXXI (Paris: Funda o Calouste Gulbenkian, 1992), 199 – 206.

⁴⁷ Almeida, *PR*, I, Pr logo, p. 17.

even in many contexts of the twentieth century, of which the Portuguese case is an example, popularization is an essentially urban phenomenon, where it involves only part of the literate population. The fact that scientific knowledge overflows beyond the limits of the production elite does not imply that we should hasten to label this process “science popularization. “Terms such as “disclosure” or “vulgarization” are more appropriate to describe the phenomena of public access to science in the eighteenth century.

Teodoro de Almeida’s *Philosophical Recreation* is a good example of how, from a historical point of view, the determination of the scientific character of a text is inextricably linked to its circumstances. One obviously risks anachronism when looking at *Philosophical Recreation* on the basis of equivalence. To vulgarize natural philosophy is not the same as, or not equivalent to, popularize science.

The apparently paradoxical fact that one is dealing with a work that was intended for the instruction of curious *people unable to attend lessons* and was, at the same time, a reference text used as a university manual, shows this. Without being popular in the proper sense of the term, it was, however, read by a wider, new type of elite, different from the hitherto usual consumers of natural philosophy. While summoning an audience until then unable to access scientific knowledge, Almeida presented them the model. The characters who populate the *PR* served as a model to the very audience to whom it was intended: Eugenio, a military man holding business in Court, a doctor, a baron, a brigadier, a colonel, a baroness, a marchioness and a bailiff.

Spanish subscribers of the *Letters* together with the Portuguese subscribers of publications vulgarizing the natural sciences such as the *Encyclopaedic Journal (Jornal Enciclopédico)* define the sociological profile of an elite indexed to new rituals and circuits of knowledge from which Latin and university scholastics were excluded. An elite, free from scholastic confinement, took the sciences and their vulgarization as a vehicle of cultural expression. This public could purchase and read the *PR* and their social status defined a degree for vulgarization and this, in turn, acted as their cultural legitimization.

If I were to choose a designation for the *PR*, I believe a “book of vulgarization of natural philosophy in the eighteenth century” would be the most appropriate.

Scientific “marvels” in the public sphere: Barcelona and its 1888 International Exhibition¹

Agustí Nieto-Galan*

Abstract

This paper examines the scientific culture of the 1888 Barcelona International Exhibition from different perspectives. Firstly, it emphasises how controversy rather than consensus imbued the everyday life of the city during that exceptional event, from April to December 1888. Secondly, the article discusses how science—including science, technology and medicine—became a tool in political debates about the pros and contras of the exhibition. Thirdly, through the careful analysis of particular case studies (public fasting, captive ballooning, electric and optical wonders, and live animal displays), the paper contributes to gaining a deeper understanding of the scientific culture in international exhibitions.

Keywords: international exhibitions, science popularization, urban history of science, Barcelona, scientific controversies

1. Introduction

In 1986, the Spanish writer Eduardo Mendoza, in his novel *City of Marvels [La ciudad de los prodigios]*, depicted the city of Barcelona in the nineteenth century in the following terms:

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“... Barcelona was always at the forefront of progress. In 1818, the *first* regular stagecoach service in Spain went into operation between Barcelona and Reus. The *first* experimental gaslight system was installed in the courtyard of the Palace of La Lonja, housing the Chambers of Commerce, in 1826. In 1836, the *first* steam-powered motor went into operation [...] Spain’s *first* railroad was built to link Barcelona and Mataró, dating from 1848. The *first* electric power station was likewise built in Barcelona, in the year 1873. The gap between Barcelona and the rest of the peninsula was enormous, and the city made an overwhelming impression on the newcomer. But all this progress had demanded a colossal effort. Barcelona [...] laid drained, exhausted. Foul emanations seeped from cracks, rancid exhalations rendered unbreathable the air in the streets and homes. Weariness and pessimism held sway among the population [...] but there were plenty of opportunities in Barcelona for people with imagination and enterprise”.²

Of course, Eduardo Mendoza is not an historian of science, but in his eagerness to emphasise scientific progress in the city, he placed Barcelona as a centre of innovation throughout the nineteenth century. Nevertheless, Barcelona can be perceived as a centre or as a periphery; as a dynamic place in terms of nineteenth-century Spanish patterns of scientific progress and industrialisation, or as a second-class European industrial city. Today this remains a historiographical challenge.³

Some years ago, the British historian of science, Jack Morrell, tried to convince us that the history of science in nineteenth-century Bradford, in northern England, mattered as much as the achievements of the great luminaries in Manchester or even in London. He admitted that many historians of science probably “...think that it is pointless to study science in places [such as Bradford, and perhaps Barcelona], which have not been associated with eminent savants and their discoveries. Others may regard [this sort of] provincial science as a hyperborean cave from which the talented were fortunately released by a beckoning metropolis”. But Morrell also reminds us that the supposed “provincial” science help us as historians “to recognize the complexities which the yearning for metropolitanism obscures”.⁴

² Eduardo Mendoza, *City of Marvels* (London: Collins Harvill. 1990), p. 12 (1st Spanish edition, Seix Barral, Barcelona 1986). [my emphasis]

³ For the centre-periphery debate in history of science see: Kostas Gavroglu et. al., “Science and Technology in the European Periphery. Some historiographical reflections”, *History of Science*, 2008, 46: 1-23.

⁴ Jack B. Morrell, “Wissenschaft in Worstedopolis: Public Science in Bradford, 1800–1850”, *The British Journal for the History of Science*, 1985, 18 (1): 1-23, on pp. 1-3.

No doubt, locality matters. It is already known that in recent years, a great deal of historical work has been carried out to analyse the role of specific sites and places in the shaping of scientific knowledge. Since 1998, when Jon Agar and Crosbie Smith edited *Making Space for Science* in order to examine the spatial foundations of science from several perspectives,⁵ a huge range of scholars have tackled the problem of space in the history of science. In 2003, in his book *Putting Science in Its Place*, geographer David Livingstone provided an impressive list of places in which science could be made in the past: houses of experiment (labs), cabinets (and museums), in the field (ships and tents), gardens of display (botanical and zoological), spaces of diagnosis (hospitals), churches, courts, pubs and coffee houses, libraries, lecture theatres, salons, observatories, etc. Livingstone questioned the universal status of science in the following terms: “Scientific knowledge is made in a lot of different places. Does it matter where? Can the location of scientific endeavour make any difference to the conduct of science? And even more important, can it affect to the content of science?”⁶ In his view, to which I subscribe, the answer to these questions is yes. In fact, it is not hard to admit that every scientific activity involves continuous interactions with specific sites.⁷ Even Fyfe and Lightman’s recent work on science in the marketplace has emphasized the importance of specific places for the popularisation of science and the establishment of particular relations between experts and their audiences.⁸ In the case of science museums, Sophie Forgan’s work has been particularly relevant.⁹

As Livingstone and others have suggested in recent years, the city is a useful container of places of scientific practices. In 2003, Sven Dierig, Jens Lachmund, and J. Andrew Mendelshon’s *Science and the city* (special *Osiris* volume), laid the foundations for further investigation on the urban history of science, on the interactions between the city itself and the loci and drama for the circulation of

⁵ Jon Agar; Crosbie Smith, (1998) *Making Space for Science: Territorial Themes in the Shaping of Knowledge*. (London: Macmillan, 1998)

⁶ David N. Livingstone, *Putting Science in Its Place: Geographies of Scientific Knowledge*. (Chicago: University of Chicago Press, 2003), p. 1; Simon Naylor, “Introduction: historical geographies of science – places, contexts, cartographies”, *The British Journal for the History of Science*, 2005, 38 (1): 1-12.

⁷ Sven Dierig, Jens Lachmund, J. Andrew Mendelshon (eds.) *Science and the city, Osiris*, 2003, 18, p. 10.

⁸ Aileen Fyfe, Bernard Lightman, *Science in the Marketplace: Nineteenth-Century Sites and Experiences*. (Chicago: Chicago University Press, 2007).

⁹ Sophie Forgan, Graeme Gooday, “Constructing South Kensington: the buildings and politics of T. H. Huxley’s working environments”, *The British Journal for the History of Science*, 1996, 29: 435-68; Sophie Forgan, “Building the Museum. Knowledge, Conflict and the Power of Place”, *Isis*, 2005, 96(4): 572-585.

knowledge.¹⁰ They distinguished four main interconnections, co-productions between science and the city:

1. The intersection between scientists and politicians gave rise to what was known as *urban expertise*.
2. Science played a crucial role in the *cultural representation of the city*: new literary genres, daily papers, photography, films, marketing¹¹.
3. Scientific activities were deeply embedded in the social and material infrastructures of the city; that is to say specific *places of knowledge* can only be properly understood through their role within the urban context.
4. There was a significant level of interaction between *science and urban everyday life*.¹² So historians had to try to describe its dramas and loci.¹³

It is precisely at the intersection between urban expertise, cultural representations, places of knowledge and everyday practices that a new history of urban history of science can emerge. Thus, in the framework of a more ambitious research project aiming to write the urban history of science of the city of Barcelona in the period 1888–1929, this paper attempts to develop a specific case study, which focuses on several manifestations of that urban scientific culture during the 1888 International Exhibition, which took place from May to December that year. In fact, international exhibitions are ideal examples for the analysis of specific practices in concrete urban sites.

Although the literature on the role of science in international exhibitions has increased enormously in recent decades,¹⁴ the subject is still elusive and hard to

¹⁰ Sven Dierig, Jens Lachmund, J. Andrew Mendelshon (eds.) *Science and the city*, ...

¹¹ Steven Ward, *Selling Places: The Marketing and Promotion of Towns and Cities, 1850-2000*. (London: Spon, 1998)

¹² On everyday urban practices, see: M. Gee, T. Kirk, J. Steward (eds.) *The City in Central Europe: Culture and Society from 1800 to the Present*. (Aldershot: Ashgate, 1999); Peter Fritzsche, *Reading Berlin 1900* (Cambridge MA: Harvard University Press, 1996); Michel de Certeau, *The Practice of Everyday life*. (Minneapolis: University of Minnesota Press, 1998); Setha M. Low, *Theorizing the City: The Urban Anthropology Reader* (New Brunswick, N. J.: Rutgers University Press, 1995). See also., Antonio Lafuente; Thiago Saraiva, “The Urban Scale of Science and the Enlargement of Madrid (1851-1936)”, *Social Studies of Science*, 2004, 34(4): 531-569.

¹³ My emphasis.

¹⁴ Robert W. Rydell, *All the world's a fair. Visions of Empire at American International Expositions, 1876-1916* (Chicago: Chicago University Press, 1984); Robert W. Rydell, *World of Fairs. The Century-of-Progress Expositions* (Chicago: Chicago University Press, 1993); Paul Greenhalgh, *Ephemeral vistas. The Expositions Universelles, Great Expositions and World's Fairs, 1851-1939* (Manchester: Manchester University Press, 1988); Jim A. Bennett, *Science at the Great Exhibition* (Cambridge University Press: Cambridge, 1983); Brigitte Schroeder-Gudehus (ed.) *Industrial Society & its Museums* (Langhorne: Harwood Academic Publishers, 1993); Schroeder-Gudehus, B., Rasmussen, A. *Les fastes du progrès. Le guide des expositions universelles 1851-1992* (Paris: Flammarion, 1992); Robert Brain, *Going to the Fair. Readings in the Culture of Nineteenth-Century Exhibitions* (Cambridge: Whipple Museum of the History of Science, 1993). Brain placed science in the heart of social stability; spaces of

tackle: too many actors, objects, spaces, public addresses, urban constraints, political projects, taxonomical debates, among many other factors suffuse the nightmare of the historians when attempting to tell something new and interesting about that kind of public event. The problem is even more serious when we try to examine second-class, peripheral international exhibitions, which apparently look like “copies” of the big scenarios in London, Paris, Vienna, or Chicago, and seem to reproduce standard patterns of display strategies and showcasing.

To overcome these difficulties, this article will provide new useful examples to further explore the abovementioned four levels of interaction between science and the city. In the “jungle” of actors, objects and events that constitute the core identity of the exhibitions themselves there are lots of *microhistories*, which deserve further attention. In the same way historians defend the epistemological value of a particular case study compared to big historical narratives, particular episodes inside the exhibition, and in the city as a whole might shed some light on the complexities of this new urban history of science, which is gaining new space in our academic landscape.

This paper does not intend to create a full reconstruction of the 1888 Barcelona World Fair. On the contrary, it only examines the urban history of science in the city by analysing an impressionistic selection of particular episodes from April to December 1888. The point here is, that during the months of the International Exhibition, the city showed its most dynamic side; full of activity and public displays and addresses, even beyond the restricted area of the official event. Using several “narrow”, “provincial” examples—borrowing Jack Morrell’s spirit when addressing the Bradford case—I will try to show that the science surrounding international exhibitions was more tinged with controversies than consensus. In addition, in peripheral contexts such as Barcelona in 1888, regardless of Mendoza’s positive statements, scientific backwardness was often placed at the centre of public debates on the nation’s progress. Local resistances, in permanent tension with foreign visitors and luminaries, also played a significant role in the shaping of the local scientific culture.

To further strengthen all of these arguments, I shall begin by introducing the reader to the main sound data of that international fair. Then, I shall move onto the analysis of the role of science in local political disputes. Finally, public fasting

representation, order of things, juries, prizes, classification, machines, international standards, nationalism/internationalism, showcases.

experiments, balloons, electric wonders and live animal displays, will help us to trace unexpected nuances of that specific urban history of science.

2. An introduction to the exhibition

Although there has been some scholarly work on the Barcelona 1888 Exhibition, a lot remains to be done in terms of analysing the role of science in that public event.¹⁵ Major historical research refers to urban growth, from the fall of the medieval walls in the mid-nineteenth century to the famous plan of the “Eixample” and the construction of the modern city from the 1860s onwards.¹⁶ Other efforts were devoted to historical comparison of the 1888 and 1929 exhibitions,¹⁷ but also to public commemorations, such as the centenary in 1988, which, while informative, lacked a more profound historical analysis.¹⁸

From all the above mentioned literature, a standard account informs that, after years of hesitation and even frequent public controversies on the pros and cons of organising it, the mayor of the city, Francesc Rius i Taulat (1833–1889), led the project with the support of local and national elites. In doing so, the Barcelona City Council radically transformed the old Ciutadella into a new park for science, industry,

¹⁵ Ramon Grau; Marina López, *Exposició Universal de Barcelona. Llibre del centenari* (Barcelona: L'Avenc, 1988); Manuel Guardia, Albert García Espuche, “1888 y 1929. Dos exposiciones, una sola ambición”, en Alejandro Sánchez (ed.) *Barcelona, 1888-1929. Modernidad, ambición y conflictos de una ciudad soñada* (Madrid: Alianza Editorial, 1994), pp. 25-43; Edmond Vallés, *Història gràfica de la Catalunya contemporània. De l'Exposició Universal a Solidaritat Catalana 1888-1907*, Vol I (Barcelona: Edicions 62, 1974); Joan García Massó, *Memòries d'un liberal catalanista*. (Barcelona: Edicions 62, 1987); Josep Pich (ed.) *Memòries de Conrad Roure. Recuerdos de mi larga vida*. Vol. IX. *La Restauració dels Borbons (II). L'Exposició Universal de Barcelona de 1888* (Vic: Eumo, 1999), VIII, pp. 67-141.

¹⁶ Pere Hereu et al., *Arquitectura i ciutat a l'Exposició Universal de Barcelona de 1888* (Barcelona: UPC, 1988); Ignasi de Solà-Morales, *L'Exposició Internacional de Barcelona, 1914-1929: arquitectura i ciutat* (Barcelona: Fira de Barcelona, 1985)

¹⁷ *Barcelona y sus exposiciones 1888, 1929. Suplemento Extraordinario de Las Noticias* (19-05-1929).

¹⁸ Among the most relevant primary sources of the 1888 Barcelona Exhibition, it is worth mentioning: Juan Artigas Feiner, *Guía itineraria y descriptiva de Barcelona, de sus alrededores y de la Exposición Universal ilustrada con cuarenta vistas y tres planos (el de Barcelona, el de sus alrededores y el de la Exposición)*. (Barcelona: Librería y Tipografía Católica, 1888); *Ateneu Barcelonés. Conferencias públicas relativas a la Exposición Universal de Barcelona* (Barcelona: Busquets y Vidal, 1889); *Exposició Universal de Barcelona 1888. Catálogo General Oficial* (Barcelona: Sucesores de N. Ramírez y C^a, 1888); Josep Franquesa Gomis, *Recort de la Exposició Universal de Barcelona de 1888. Poesia de Josep Franquesa i Gomis. Premiada ab una medalla oferta per l'Exm. Ajuntament de Barcelona en los Jochs Florals del any 1890* (Barcelona: La Renaixensa, 1890); Carlos Frontaura, *Barcelona en 1888 y París en 1889 (narraciones humorísticas)* (Valencia: Pascual Aguilar, 1889); Antonio García Llansó, *La Primera Exposición Universal Española, por Miembro del Jurado Calificador, designado por el Imperio del Japón y de la Comisión representativa de los expositores de las Islas Baleares* (Barcelona: Luis Tasso, 1888); C. Gumà, *Guía Cómica de l'Exposició Universal de Barcelona*. (Barcelona: Llibreria Espanyola de López, 1888); Saturnino Lacal, *El libro de honor. Apuntes para la Historia de la Exposición Universal de Barcelona. Premios concedidos y dictámenes que los productos expuestos merecieron del jurado internacional. Por el inspector especial del mismo Don Saturnino Lacal con la colaboración de distinguidos jurados* (Barcelona: Tipografía de Fidel Giró, 1889); Juan Valero de Tornos, *Barcelona tal cual es, por un madrileño (de ninguna academia)* (Barcelona: Sucesores de N. Ramírez, 1888); Juan Valero de Tornos, *Cuarenta Cartas, Conato de Historia y descripción de la Exposición Universal de Barcelona* (Barcelona: Pedro Ortega, 1888); Juan Valero de Tornos, *Guide illustré de l'Exposition Universelle de Barcelona en 1888. De la ville, de ses curiosités et de ses environs*. (Barcelona: G. de Grau et Cie, 1888).

and art.¹⁹ The fortress of the Ciutadella was built by Philip V in the early eighteenth century, at the end of the War of Succession, to punish and control Barcelona inhabitants, who had resisted against the Bourbon dynasty in favour of the Habsburgs and defended their political freedom. More than a century and a half later, Barcelona was a province of the restored monarchy and suffered from tensions with the central political power in the Court in Madrid, with the economic, industrial leadership of the kingdom mainly situated in Catalonia, in particular, in its powerful textile industry. In addition, Catalan culture, which had suffered from a long period of marginalisation, seemed to be reborn with the “Renaixença”, a dynamic cultural movement claiming the recovery of Catalan language and literature. Extended to what is known as “Catalanism”, this movement supported the progressive development of a political framework that secured economic, political and cultural autonomy from Spain. As will be discussed later in the paper, the whole project of the 1888 International Exhibition should therefore be analysed in this particular context of competing nationalism and political ideologies.

In the new Ciutadella (Figure 1), pavilions of science (*Ciencias*) (5), arts (*Bellas Artes*) (4), industry (22), agriculture (7), hall of machines (*Galería de máquinas*) (29) made their own space together with remarkable buildings such as the “*Hivernáculo*” (13), the “*Umbráculo*” (15), the Eiffel-like iron bridge (39) – linking the exhibition ground to the harbour, the Triumphal Arch (2), the Martorell Museum (14), and the restaurant *El Castell dels tres Dragons* (11). The whole endeavour contributed to a deep urban transformation of the city (Figure 2), which transcended the strict areas of the exhibition. Examples include the building of the Columbus Monument (1), in honour of the discoverer of America, and the construction of the ephemeral International Hotel (*Hotel Internacional*) (3), which became the meeting point of national and international elite visitors. In the city, those impressive constructions, near the exhibition ground, were also complemented by other spaces such as panoramas (9, 10, 11), the equestrian circus (8), the maritime exhibitions, which, together with other buildings and showcases became the attraction for visitors.

¹⁹ Antonio García Llansó, “La Exposición Universal de Barcelona”, *La Ilustración*, 385, 1888, p. 182.

Of a total surface area of 465,000 m², roughly 100,000 m² were devoted to buildings to display products from Barcelona, Catalonia and Spain as a whole, but also from many other nations.²⁰

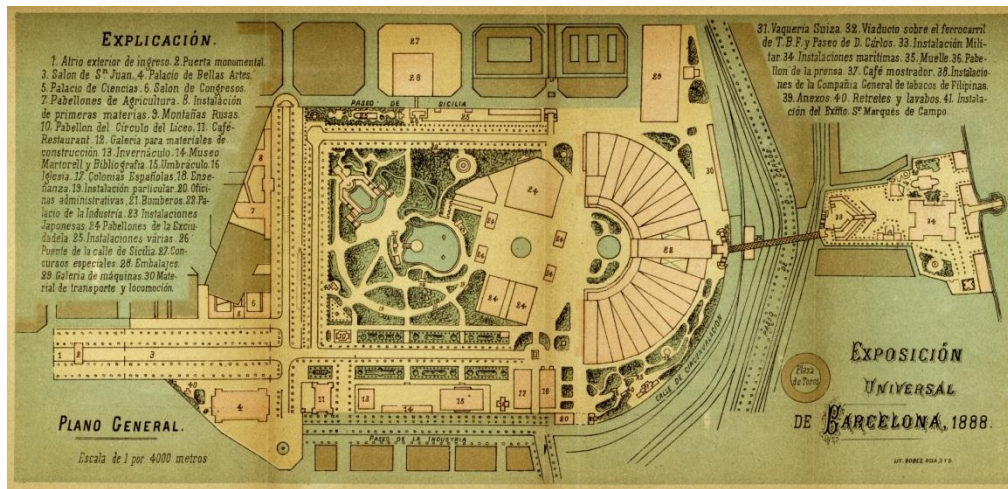


Figure 1 - Sites of the 1888 Exhibition (in the Ciutadella Park). Triumphal Arch (2); *Palacio de Bellas Artes* (4); *Palacio de Ciencias* (5); *Salón de Congresos* (6); *Palacio de Agricultura* (7); Café-Restaurant (11); *Hivernacle* (13); Martorell Museum (14); Umbracle (15); *Palacio de la Industria* (22); *Galería de Máquinas* (29), Juan Valero de Tornos, *Guide illustré de l'Exposition Universelle de Barcelona en 1888. De la ville, de ses curiosités et de ses environs. Text de Direction artistique de Juste Simon.* G. de Grau et Cie. Barcelona, 1888.



Figure 2 - Sites of the 1888 Exhibition (in the city, outside the Ciutadella park) Columbus Monument (1); Gran Hotel Internacional (3); Equestrian circus (8); Panorama Waterloo (9); Panorama Plewna (10); Panorama Montserrat (11); Roller coasters (12); Maritime Exhibition (13), Juan Valero de Tornos, *Guide illustré de l'Exposition Universelle de Barcelona en 1888. De la ville, de ses curiosités et de ses environs. Text de Direction artistique de Juste Simon.* G. de Grau et Cie. Barcelona, 1888.

²⁰ *Exposición Universal de Barcelona 1888. Catálogo General Oficial.* (Barcelona: Sucesores de N. Ramírez y C^a. 1888). In practice, the surface was distributed as follows: 4,200 m² Barcelona; 3,200 m² Spain; 500 m² Belgium; 2,500 m² France; 1,000 m² Austria; 600 m² Hungary; 1,600 m² Germany; 500 m² Italy; 1,600 m² England; 1,000 m² Russia; 1,000 m² Portugal; 1,000 m² USA; 1,000 m² Spanish America *América española*. In terms of foreign contributions, French products were hegemonic, close to 2,000 exhibitors; followed by Germany (200), England (200), Italy (128), United States (86), and at a lower level: Austria–Hungary, Belgium, Bolivia, Chile, China, Colombia, Denmark, Ecuador, Holland, Honduras, Japan, Mexico, Paraguay, Portugal, Argentina, Russia, Sweden, Norway, Switzerland, Turkey, Uruguay.

Although the public had access to the exhibition from 8 April onwards, the official opening ceremony took place on 20 May 1888 at the *Palacio de Bellas Artes*, in the presence of the Spanish royal family, the main political authorities of the Spanish Restoration Monarchy, including the Prime Minister, Mateo Sagasta (1825-1903), and his government. They were accompanied by foreign royal families and ambassadors, other civil, military and ecclesiastic authorities, noblemen, the City Council, members of the provincial Council of Barcelona and other representatives from scientific, literary, commercial and industrial circles. The crowd, around 30,000 people, gathered enthusiastically at the Ciutadella.²¹ Although figures of visitors were uneven, there is a general agreement that more than one million visits had already taken place by December that year, when the whole event was close to its end.

The exhibition was also an excellent occasion to hold international meetings. It is worth mentioning for instance, the *Congreso Nacional Pedagógico* (National Pedagogic Conference), which was held in the *Paraninfo* (Great Hall) of the University of Barcelona. The conference hall of the *Palacio de Ciencias* hosted other conferences such as the *Congreso de Jurisprudencia* (Jurisprudence Conference); *Congreso médico-farmacéutico* (Medical–Pharmaceutical Conference); *Congreso nacional de Arquitectos* (National Architecture Conference); *Congreso nacional económico* (National Economics Conference); and the *Congreso internacional de ingeniería* (International Engineering Conference).²² Curiously, the popular *Congreso espiritista* (Spiritualist Conference) took place outdoors during the Exhibition, with a significant female audience and international representatives.²³ All those conferences, in spite of their unbalanced scientific quality—as contemporary actors often denounced—brought a hint of cosmopolitanism to the exhibition, which reinforced the whole project.

All these data are perfectly in line with standard accounts provided by official guides and discourses given by elites who were closely involved in the organisation of the event. However, behind that rhetoric of success and progress, laid plural views and voices on the pros and cons of the exhibition, and more importantly, as we will see in the next sections, on contemporary actors' diverse assessments of the “quality” of the science exhibited and the role of science in the cultural endeavour as a whole.

²¹ García Llansó, “La Exposición Universal de Barcelona”, *La Ilustración*, 395, 1888, 339.

²² Lacal, *El libro de honor. Apuntes para la Historia de la Exposición Universal de Barcelona*, Cap. VIII

²³ Pich (ed.) *Memòries de Conrad Roure*, IV, p. 132.

3. Local science for local politics

Historians have focused recently on the role that science played in the creation of new cultures of control in the so-called “second industrial revolution”, in which urban growth, museums, and obviously international exhibitions would have acted as powerful cultural weapons for the interests of urban elites.²⁴ Miriam Levin has stressed recently how objects, networks, institutions and social elites that led science projects shaped city life with urban plans for expansion, and with a “scientific” reformulation of the past in museums to legitimise linear progress, but also to imagining the future in world fairs.²⁵ For the latter she provided the example of Paris in 1889 with the famous *Galérie des machines* that accompanied the Eiffel Tower, or the *Palais de l’électricité*.²⁶ Likewise, Sophie Forgan examines the way in which urban elites shaped London’s life and culture through science in museums and exhibitions from the 1870s to the 1st World War. In her view: “London’s culture of change in this period was characterized by enthusiasm for technological modernity (accompanied by a sense of progressive evolutionary development), a devotion to free enterprise and respect for local autonomy, and a keen attachment to historical continuity”.²⁷

Of course, the elites’ interests, perceptions and projects were also fundamental in Barcelona, but, as in many other local contexts, their public discourses and ambitions took a particular shape. Far from the triumphal narrative of progress appearing in official guides, the exhibition was from the beginning captured in a bitter debate on the enterprise as a whole. Conservative discourses were in general favourable towards the exhibition, but liberal middle classes expressed more reluctance in public, and working class organisations were often bitterly critical.

Take for instance the monarchic conservative journalist Juan Valero de Tornos (1842–1905). Valero considered the event a success.²⁸ For him, great heroes could be found without difficulty in the official catalogue among local political and economic elites, whereas the critics were perceived as provincial and narrow-minded. In fact, the exhibition’s board of directors was composed of local politicians and

²⁴ Miriam Levin, Sophie Forgan, Martina Hessler, Robert Kargon, Morris Low, *Urban Modernity. Cultural Innovation in the 2nd industrial revolution* (Cambridge MA.: The MIT Press, 2010).

²⁵ Miriam Levin, “Dynamic Triad: City, Exposition and Museum in industrial Society”, in *Urban Modernity*, 1-12, p. 11-12.

²⁶ Miriam Levin, “Bringing the future to Earth in Paris, 1851-1914”, in *Urban Modernity*, pp. 13-73, p. 33.

²⁷ Sophie Forgan, “From Modern Babylone to White City: Science, Technology and Urban Change in London, 1870-1914”, in *Urban Modernity*, 1870-1914.

²⁸ Valero de Tornos *Cuarenta Cartas*, p. 9.

entrepreneurs,²⁹ and an official commission with scientists, architects and urban planners.³⁰ In a similar vein, the writer and journalist, Carlos Frontaura (1834-1910) was radically in favour of the exhibition, close to Joan Mañé i Flaqué (1823-1901) and the conservative position of his newspaper, the *Diario de Barcelona*. On a fictional trip to the exhibition, Frontaura described a visitor who contacted the leading actors of the organisation of that event, and enjoyed the company of Colonel Francisco López Fabra, the president of the jury, during his visit to several pavilions. The visit to the *Palacio de la Industria* and its textile machinery, together with the Eiffel-style iron bridge vividly impressed that visitor – Frontaura’s alter ego.³¹

However, in spite of all this triumphalist rhetoric, elite’s public addresses were by no means homogeneous. Hegemonic discourses on the supposed benefits of heavy public investments in the Exhibition were counterbalanced on different fronts.³² As stated before, the contrast between Spanish, politically centred interests in Madrid and the aims of the Catalan industrial and cultural elites soon became a source of deep controversy. Dissenting voices, especially among Catalanist circles, were led by the lawyer and writer Valentí Almirall (1841-1904), one of the founding fathers of modern political Catalanism.³³ Almirall published several critical articles in the journal *La Veu del Centre Català*, in which he expressed the reasons for his rejection of the Exhibition.³⁴ He blamed the organisers for the serious delay in the public works and building of pavilions, for a too-hasty opening ceremony, for the low number of visitors and for the political control of the event by the Court in Madrid.³⁵

²⁹ Francesc Rius i Taulet, honorary president; Josep Pujol i Fernández, executive president; Francisco López Fabra, vicepresident; Eugenio Serrano Casanova, general secretary; Carlos Pirozzini, Secretary; Manuel Girona, Royal Comissionate; Manuel Porcar Tió, vocal; Josep M^a Nadal, vocal; Félix Macià Bonaplata, vocal ; Ramón Macaya Gibert, vocal ; Andrés de Sard Rosselló, vocal; Ramón de Manjarrés, vocal; Francisco Sitjà, vocal. Pich (ed.) *Memòries de Conrad Roure*, IV, p. 67.

³⁰ Asuntos generales: Duran y Bas; Obras: Elías Rogent; Contabilidad: F. Gumá; Técnica: Bernardino Martorell; Instalaciones: Ramón de Manjarrés; Propaganda: Frederic Nicolau; Servicios interiores: José Vilaseca; Servicios exteriores: Evaristo Arnús; Festejos: Frederic Marcel; Premios: Francisco López Fabra; Expositores: Camilo Fabra. *Exposición Universal de Barcelona 1888. Catálogo General Oficial*.

³¹ Frontaura, *Barcelona en 1888 y París en 1889*, p. 50. Several journalists working at the *Diario de Barcelona* published articles on the 1888 Exhibition: Mañé i Flaqué, Luciano Ribera, Francisco Miguel y Badía, Vidal y Valenciano.

³² For the plurality of voices surrounding the Great Exhibition of 1851 in London, see: Louise Purbrick (ed.) *The Great Exhibition of 1851. New interdisciplinary Essays* (Manchester: Manchester University Press, 2001).

³³ García Llansó, “La Exposición Universal de Barcelona”, *La Ilustración*, 389, 1888, 243-244.

³⁴ Valentí Almirall, “En l’actualitat”, *La Veu del Centre Català*, 33, 26-5-1888, 195-196; 34, 16-6-1880, 202-203.

³⁵ *La Veu del Centre Català*, 33, 26-05-1888, 195-196. He denounced the lack of visitors even after the presence of the monarchy in the city. “Fa dos mesos que va obrir-se, y ab tot y haver estat á Barcelona la Regenta del Regne ab tota sa Cort, y un gran número de prínceps y personatjes, no ha fet en els primers 50 dies mes de seixanta mil entradaes. Aquest resultat es tant pobre y mes aquí, que deixa molt enrera los cálculs que nosaltres havíem fet y que varen ser considerats com pessimistes”; “Y tot això ho fa Barcelona volentse posar no ja al nivell, sino per damunt de París, Londres, Viena y Filadelfia. Totes aquestes grans ciutats van fer llurs exposicions ab la ajuda

Others who reinforced Almirall’s position believed that the support Rius i Taulet was receiving from the Spanish government was part of a plan to beat Almirall and his Catalanist–federal project. In a public lecture at the *Ateneu Barcelonès*, a prestigious cultural institution that monopolised political debates in the city from the late nineteenth century onwards, the writer and journalist Josep Yxart (1852-1895) listed his main objections towards the project: the local and national economic crisis that the city was suffering at the time; the industrial weakness of the nation; the proximity in time to the 1889 Paris Exhibition; but also the lack of experience in these ambitious events; the lack of a reliable urban transport and communication network, together with the decadence of the old town and its difficult renewal.³⁶ In a similar way, others such as the electrical engineer Antonino Suárez Saavedra (1838-1900) criticized the enormous public investment of money instead of putting it to more “useful” projects such as urban sewage, water pipes, street pavements, and even public monuments and artistic statues.³⁷

But uneasiness also came from the lower classes. As occurred elsewhere, local urban elites in Barcelona encouraged the working classes to visit the exhibition. The Barcelona board distributed cheap tickets in working-class suburbs for potential visitors on Sundays. In the same way, railways and tramways offered cheaper prices for workers on those days,³⁸ and workers from other Spanish cities were granted

efectiva del Estat, que va concedirlos grans subvencions a tota perdua. Barcelona no reb més que un avens de diners del Govern, que després deurà tornarli, quan la ruina sigui completa. Al pensar en això, no podem deixar d’exclamar: ¡Es que’ns hem begut l’enteniment? Lo que hem indicat es prou trist, pero no ho es menos la síntesi que vam treure de la nostra visita a las obras de la Exposició. Tenim la seguretat que ¡iNo s’obrirà pas lo dia senyalat, o sigui lo 8 d’abril!! Tanta es la nostra seguretat que acceptem una posta ab qui vulgui ferla”, *La Veu del Centre Català*, 8, 03-12-1887, p. 44; “¿Se volen mes datos? Aquí van: La Exposició de Filadelfia [1876], com entrada máxima, va tenir en un sol día 250.000 visitants. La esmentada de Paris [1867], lo diumenge día 27 de octubre, va tenirne 173.923. La de Viena [1870], lo día 2 de novembre va tenirne 135.675. La pobra de Barcelona, l’endemà mateix de la inauguració per la Regenta, quan al port hi havia 20.000 marins de guerra y a la ciutat s’hi havia reunit la gent de la provincia, va arribar a 7000 entrades ¡!”, *La Veu del Centre Català*, 34, 16-06-1888, p. 202.

³⁶ Joseph Yxart, “La exposición por fuera”, in *Ateneu Barcelonés, Conferencias públicas relativas a la Exposición Universal de Barcelona*, 117-142, p. 123.

³⁷ “Me preguntaba yo a mi mismo, no imbuido en la oposición sistemática de tal o cual periódico, sino en virtud de mi propio criterio, si los millones que se iban a gastar en edificios, que luego habían de venir a tierra, no tendrían en parte mejor empleo en realizar las grandes obras de las cloacas de desinfección y en dotar de abundantes aguas a esta capital, reformas ambas brillantemente desarrolladas y sostenidas desde este mismo sitio por ilustrados miembros del Ateneo; me preguntaba si parte de esos millones no estarían mejor empleados en las reformas internas de la población, en el adoquinado de las calles del ensanche, en monumentos y obras de arte distribuidos convenientemente...”, Antonino Suárez Saavedra, “La electricidad en la Exposición Universal de Barcelona”, in *Ateneu Barcelonés, Conferencias públicas relativas a la Exposición Universal de Barcelona*, 373-403, p. 373.

³⁸ (15-XI-1888): “Deseando la Comisión ejecutiva que puedan visitar la Exposición los obreros de esta capital y sus subúrbios, he dispuesto que se distribuyan 60.000 entradas valederas para los tres domingos próximos...Se remitirán un número proporcional de entradas a cada uno de los expositores de todas las demarcaciones que tengan sus industrias en esta capital o sus alrededores a proporción de la importancia de las instalaciones que tienen hechas para que puedan distribuir las entre sus obreros o trabajadores...” Arxiu Administratiu de Barcelona, Box 42585. “...con las empresas de ferro-carriles y tranvías la concesión de billetes baratos de ida y

admission to the Barcelona fair by their own private firms and by the public administration.³⁹ Among the lower classes, science was praised and admired—sometimes too uncritically—but its appropriation by the upper classes was bitterly rejected. All those actions of “polite despotism” did not stop criticism by workers’ organisations. This was for instance the case of *El Productor*, a socialist newspaper that bordered on anarchist ideas, which, in anonymous articles, denounced issues such as the false rhetoric of peace, the commodification of knowledge, and the corruption of the juries.⁴⁰ From that political perspective, the exhibition was a “bourgeois” display of luxury goods and waste, of no interest to workers. Horse races, bull fights, concerts, fireworks, military parades: “in a word, wealth, wealth, a lot of wealth...in front of all this waste, we have to show our nakedness; in front of all this amusement, our protest meetings”.⁴¹

But science played a central role in the debate. Critics such as Almirall presented the whole event as “scientifically weak” and backward. Almirall perceived the *Palacio de Ciencias* (Figure 3) as miles away from the scientific “temples” of the great exhibitions in London, Paris, Vienna, Chicago and Philadelphia. His words of disappointment are worth mentioning:

“...we have to admit that this exhibition does not hold any of the character of those fairs called universal fairs up until now. Apart from the industry pavilions, all the rest does not even nearly reach those bazaar exhibitions that take place every year by the dozen. The Science Pavilion in itself is capable of disappointing the pretensions of the most exaggerated. Four pots of pills and drugs, a desert of dynamite and some vulgar tasks of schools, constitute Spanish science in its entirety. Even the halls of the industry pavilion have been artificially filled”.⁴²

vuelta, valederos durante la tarde del sábado hasta la mañana del lunes”, Carlos Pirizzini’s correspondence. Pirozzoni to Louis Rouvière (03-08-88). Ms 5031-I. Biblioteca de Catalunya. Barcelona

³⁹ This was for instance the case of the Diputación de Madrid, which funded the trip of a group of skilled industrial workers “moldedores de hierro, obreros mecánicos, caldereros, maquinistas” to visit at the Exhibition any display related to their own metiers. Arxiu Administratiu de Barcelona, Box 42585.

⁴⁰ *El Productor, Periódico Socialista*, 20-04-1888, 04-05-1888, 14-12-1888.

⁴¹ “...en una palabra, riqueza, riqueza, mucha riqueza...En frente de este despilfarro, debemos mostrar nuestra desnudez. En frente de estas diversiones, nuestras reuniones de protesta”, *El Productor, Periódico Socialista*, 04-05-1888

⁴² “...hem de confessar que la tal Exposició no té cap caràcter de les que fins avuy se han dit universals. Fora dels pavellons de la indústria, tot lo demás no arriba de tros a qualsevol de aqueixes exposicions bazars que’s celebren cada any per dotzenes. Lo Palau de ciències per si sol es capàs de tirar per terra las pretensions dels mes exagerats. i Quatre pots de píldoras y específichs, unes postres de dinamita y algunas labors vulgars de escoles, constituyesen tota la ciencia espanyola. Les mateixas naus del Palau de la Indústria se han omplert artificiosament.” *La Veu del Centre Català*, 34, 16-06-1888, p. 20216.

Conrad Roure (1841-1928), a republican lawyer and follower of Almirall, regarded the exhibition as low scientific level, lacking of foreign luminaries and significant scientific novelties.⁴³

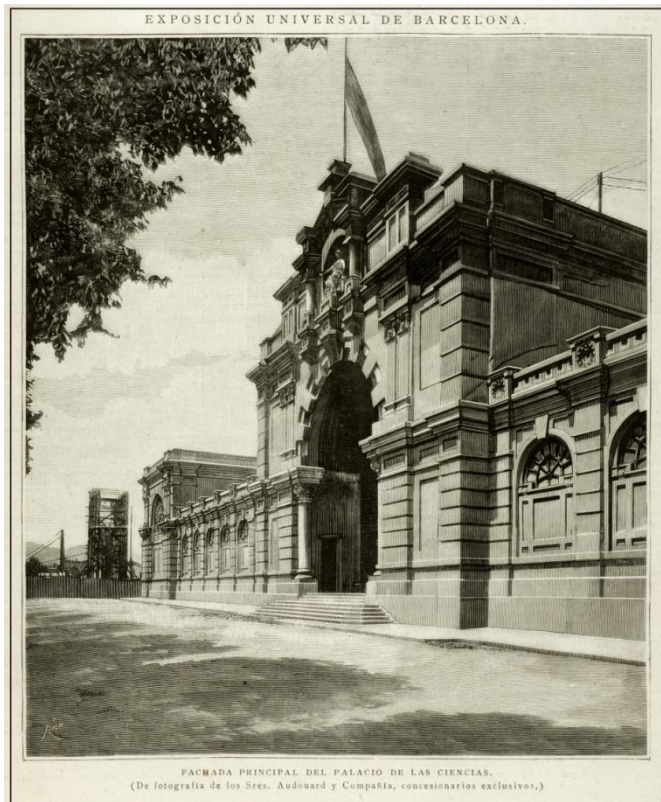


Figure 3 - The *Palacio de Ciencias* (Science pavilion), *La Ilustración. Revista Hispanoamericana*, 1888, 410:580.

Joan Molas' (1854-1904) satirical poem addressed the problem as follows:

“Being of science the site
There is, generally speaking,
A lot of industry and little science
Few problems are solved
No questions are asked...”⁴⁴

In a similar line, in another satirical text, C. Gumò expressed his reluctance toward the quality of the content of the science pavilion as follows:

⁴³ Pich (ed.) *Memòries de Conrad Roure*, IV, p. 127.

⁴⁴ “Sent de Ciències lo local/hi ha, parlant en general/molta indústria i poca Ciència/s’hi resolen pocs problemes, no’s planteja cap qüestió...”, Joan Molas Castas, *La Gran Exposició. Poema Festiu a lo que siga. Dividit en varios cants y escrit ab varietat de metros per Dibuxos de R. Miró Falguera*l'autor d'aquest poema, acompanyat de Mossen Borra, cèlebre bufon del sigle XV, visitarà la Exposició Uniuersal de Barcelona de 1888. 3^a edició (Barcelona: F. Giró. 1888). (my emphasis)

“You can see, then, that it was
 a big inconvenience
 naming such a big mess
 a science pavilion;
 Thus, the formal visitor
 often says, when leaving the exhibition:
 The pavilion is very good
 But the science...very bad”.⁴⁵

Nevertheless, as a reaction to that discrediting of science, local inventors and Catalan and Spanish firms claimed their intrinsic value and quality, and proudly exhibited their achievements in the science pavilion, but also in the *Palacio de la Industria*. Official guides emphasized concrete achievements made at the *Palacio de Ciencias*.⁴⁶ The science pavilion exhibited around 500 books from local publishers on: maths, physics, natural science, medicine, pharmacy, religion, statistics, agriculture, industry, navigation, literature, music and drawing.⁴⁷ Any object was automatically associated with the name of a local inventor.⁴⁸ Moreover, at the *Galería de máquinas*, local prestigious firms such as *La Maquinista Terrestre y Marítima* and *La Nueva Vulcano* exhibited their last novelties.⁴⁹ The Catalan metallurgy industry displayed new engines and machines. Although great foreign names of invention were engraved on the entrance walls of the *Galería* (Papin, Fulton, Franklin), there were constant demands to dignify local achievements.⁵⁰

⁴⁵ “Vejin, pues, si no ha sigut/Un capdell d’incoveniències/Da’l nom de Palau de ciencias/a un desgavell tan gruixut/Per xò’l visitant formal/Sol dir, quan surt a carré:/Lo palau está molt bé;/Pero las ciencias...molt mal”, Gumà, *Guia còmica*, p. 70 (my emphasis)

⁴⁶ Frontaura, *Barcelona en 1888 y París en 1889*, pp. 62-63.

⁴⁷ Frontaura, *Barcelona en 1888 y París en 1889*, p. 72; being the main local publishers: Bastinos, Montaner y Simón, Espasa, Cortezo, Sucesores de Ramirez.

⁴⁸ Chemistry and physics instruments (Jordi, Rubert, Solet), glass and ceramics, (Tallada, Lora); aircraft plans (Fradera), orthopedics (Calusoles, Casanoves, Cortacans), Municipal School for blind and deaf, stuffed animals (Malagrida Jornis), Chalk, alabaster (Juan Omedes), collections of minerals, (Manuel Gispert Pujals), azulejos (Tremoleda), gas pipes (Vda. De Manuel Tomás), electric wires (Vilafranca), chirurgical operations chairs (Macià), compressed air devices (Marsillach), vaccination apparatus (Macaya), a therapeutic bed (Mir), an arotherapy instrument (Díaz de Liaño), astronomical instruments (Santolaria y Miralles/Morales Valero), chemicals from Barcelona apothecaries, works by students of municipal schools, and around 300 Catalan machines and instruments for agriculture. Carlos Frontaura, p. 68

⁴⁹ *Barcelona y sus exposiciones 1888, 1929*.

⁵⁰ Valero de Tornos, *Cuarenta Cartas*, pp. 234-244. The Exhibition held an “Edison” section. Justus von Liebig’s meat extract was regularly advertised and displayed: “Compañía Liebig. Verdadero extracto de carne Liebig. 10 Medallas de Oro y diplomas de Honor. Caldo concentrado de carne de vaca utilísimo y nutritivo para las familias y enfermos. Exigir la firma del inventor Barón Liebig de tinta azul en la etiqueta. Se vende en las principales

Just as a small example, we know that Albert Billeter (1815-1895) and his astronomical, geographic clock was particularly popular, but also a peculiar machine, the “esciographe”, invented by Mr. Tarrés i Puigsech.⁵¹ But visitors were also fascinated by the “Escuder boule” because of its constant circular movement under a kiosk in the exhibition.⁵² Photographic cameras, telegraphs, telephones, medicinal plants, chemicals, experimental physics instruments, and other objects made by local inventors and firms were also exhibited and widely publicised.

As occurred ten years later, with the Spanish 1898 colonial crisis and the loss of Cuba and the Philippines, in 1888, science was at the centre of public debates.⁵³ Unlike scientific optimism and the rhetoric of progress of the official standard accounts, science was at the core of other controversies, which were tinged by local political and cultural issues. In addition several spectacles and public shows became part of the intrinsic amusement of the fair, but they also brought to the fore serious debates on the public image of science and the local mechanisms of scientific authority and political power, which also deserve further analysis in the following sections of the paper.

4. Controversial medicine

At the end of August 1888, the Italian hunger artist, Giovanni Succi arrived in Barcelona. In 1885, he came across a liquor in Rome, the “yanos water”, which he supposedly had discovered during his African trips. The liquor numbed his stomach and allowed him to fast for days and days; he ingested small quantities of this narcotic to avoid symptoms of hunger, and only drank Vichy mineral water and some purgatives.⁵⁴

Succi had been subjected to public experiments of 30 days’ fasting in several European cities (Figure 4 (1)).⁵⁵ After taking active part in the Spiritualist

Droguerías, Farmacias y Casas de comestibles. El extracto de carne Liebig ha obtenido otro Diploma de honor en la Exposición Internacional Farmacéutica de Viena (Austria) en 1883”, *La Ilustración*, 1888, 395, p. 352.

⁵¹ Valero de Tornos, *Guide illustré de l’Exposition*, pp. 189-190.

⁵² “Escuder, un fabricante ingeniosísimo que ha logrado fijar la atención de todos los visitantes de la Exposición con el constante movimiento de una bola colosal en rededor de la cubierta del kiosko en que se exponen sus máquinas. Mucha gente se quedó sin saber cómo se daba impulso a la bola de Escuder, no viéndose correa, hilo, alambre ni cosa tal que pudiera ponerla en comunicación con el motor que hacía funcionar las máquinas”, Frontaura, *Barcelona en 1888 y París en 1889*, p. 68.

⁵³ Agustí Nieto-Galan, “The images of science in modern Spain. Rethinking the ‘polémica’”, in *The Sciences in the European Periphery during the Enlightenment*, ed. Kostas Gavroglu (Dordrecht: Kluwer, 1998), 65-86.

⁵⁴ Eusebio Martínez de Velasco, “El viajero italiano Juan Succi en el día vigésimo octavo de su ayuno”, *La Ilustración Española y Americana*, 1886, 36: 182.

⁵⁵ “Y cuenta haber verificado uno de 60 días bajo el sol tropical del desierto de Nubia y otro en El Cairo, haciendo jornadas de 27 kilómetros a los once días de no haber ingerido la más pequeña porción de la sustancia alimenticia.

Conference held in Barcelona in early September, Succi was ready for his fasting spectacle at the *Palacio de Ciencias* in the exhibition itself.⁵⁶ His health and behaviour were checked daily by several local commissions to make sure that Succi was not ingesting any other kind of nourishment. By purchasing a ticket, the public was allowed to visit him in his room at the *Palacio de Ciencias*, and 20% of the revenue was donated to the poor (Figure 4 (2)).⁵⁷ He practiced gymnastics, horse riding and swordplay as a public demonstration of his perfect health condition day after day. There is evidence to believe that he received around 7,000 paying visits.⁵⁸

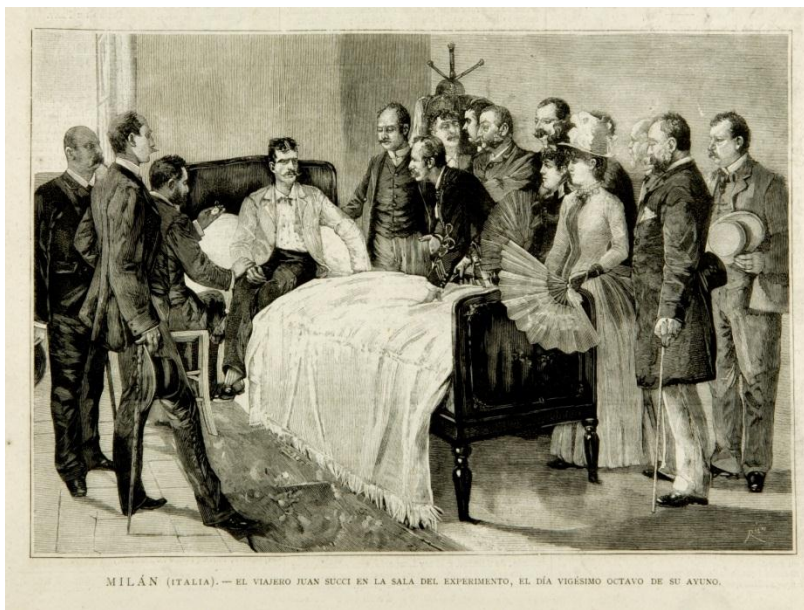


Figure 4 (1) - Succi in Milan in 1886. Eusebio Martínez de Velasco, “El viajero italiano Juan Succi en el día vigésimo octavo de su ayuno”, *La Ilustración Española y Americana*, 1886, 36:189.

Públicamente y bajo la observación directa de comisiones científicas ha practicado ayunos en París (diciembre de 1886), en Milán (agosto y septiembre de 1886); en Forlì (junio de 1886) y en Florencia (marzo de 1888). Avelino Martín y Montellá, *El ayuno de Succi. Contribución al estudio de la inanición* (Barcelona: Tipografía de la Casa Provincial de Caridad, 1889), p. 4.

⁵⁶ On the history of fasting artists, see: Walter Vandereycken and Ron van Deth, *From Fasting Saints to Anorexic Girls. The History of Self-Starvation* (London: The Athlone Press, 1994).

⁵⁷ “El día 20 comenzará su ayuno número 25, el famoso experimentador italiano. El ayuno durará treinta días y será vigilado por una Comisión médica. Durante los días de la experiencia, el señor Succi hará toda clase de ejercicios para demostrar que su estado es el de perfecta salud y que el ayuno no le hace á beneficio de estado alguno patológico de su estómago. Los ejercicios serán de gimnasia, equitación y esgrima principalmente, y estará en cualquier momento dispuesto a volver á la alimentación común, si así se lo ordenara la comisión médica. El señor Succi, durante los 30 días tomará solamente: el primero unas gotas de un licor destinado á adormecer la sensibilidad del estómago, y en los demás sólo hará uso del agua de Vichy y de la de Rubinat. Todos los días hará el lavado del estomago, analizándose luego aquel para probar si contiene alguna sustancia extraña. Durante la experiencia podrá visitarse al señor Succi mediante el pago de cierta cantidad. Estas cantidades serán intervenidas por la Comisión médica, y del producto total destina el señor Succi el 20 por 100 a los pobres de esta ciudad”, *La Vanguardia*, 16-09-1888, p. 2.

⁵⁸ Entry tickets for Succi’s spectacle were of two “reales” (half a peseta). Since the 20% of the revenue for the poor reached 700 pta, we can conclude that the approximate figure of official visitors was 7000. “Succi en el Ateneo”, *La Vanguardia*, 17-11-1888, p. 1.

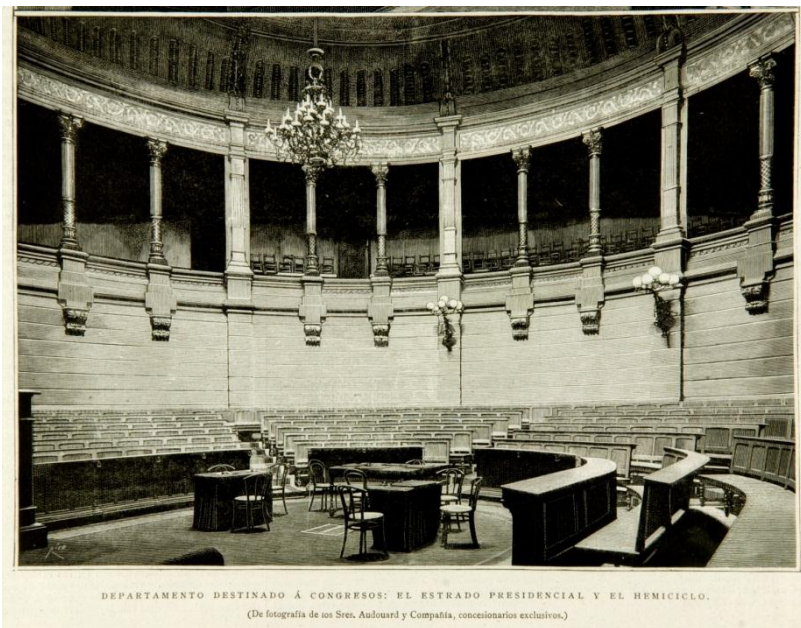


Figure 4 (2) - The Conference hall of the *Palacio de Ciencias* (Science pavilion), *La Ilustración Española y Americana*, 1888, 125: 821.

Succi’s experiment was actually supervised by a local medical commission, led by the pro-homeopathy doctor, Javier de Benavent (1850-1930) and composed of prestigious physicians. But he was also under the control of a press commission of local and foreign journalists, together with a third commission comprising students of the Faculty of Medicine, and open to other persons broadly interested in the ‘progress of physiology’.⁵⁹ As well as all the members of the three commissions, there was a swordplay professor, a photographer, a translator and 3 guards. A series of medical indicators were measured daily in his body: blood and urine, weight, temperature, breathing, pulse, strength and spirometry.⁶⁰

Beyond the restricted area of the exhibition, Succi also contrasted the authority of his performance in other sites; on 19 September 1888, he was introduced by Benavent⁶¹ at the *Sección de Ciencias Exactas y Naturales* in the *Ateneu Barcelonés*.⁶² Seeking scientific recognition, Succi tried to convince the members of the *Sección* that his experiment was based on solid physiological principles. In his view, his earlier

⁵⁹ “Este ayunador sujetó su experimento a la inspección de tres comisiones: Una comisión médica presidida por el doctor Benavent, y en la que figuran reputados clínicos de esta ciudad. Una comisión de la prensa y una tercera comisión constituida por estudiantes de Medicina y amantes del progreso de la fisiología”, Martín y Montellá, *El ayuno de Succi*, p. 5

⁶⁰ Among medical doctors is worth mentioning: Salvador Badia, Ramón Roig, Juan Pijoan, Juan Bassols, Julián Guerrero, and Avelino Martín. Names of journalists were: Chiloni, Vera, Litrán and Cristiés. Javier de Benavent, *Ayuno Succi, por el médico homeópata Javier de Benavent y de Camón* (Barcelona: Tipografía de Busquets y Vidal, 1890), p. 5.

⁶¹ Benavent, *Ayuno Succi; Benavent, Propaganda Homeopática* (Barcelona: Imprenta de Collazos y Tasis, 1897).

⁶² *La Vanguardia*, 19-09-1888, pp. 2-3.

shows in different cities and the numerous recommendation letters from foreign doctors endorsed his credibility.

On 30 September 1888, as another test to control his health during that daring experiment, Succi, Dr Benavent, Dr Roig and the journalist Mr Chiloni rose up to 300 meters high in one of the greatest attractions of the exhibition, the captive balloon (*globo cautivo*). No dizziness or any kind of sickness or distress was reported in Succi.⁶³ Two weeks later, on 15 October, the city as a whole became a “jury” for Succi’s achievements. Accompanied by several members of the commission, Succi walked for one and a half hours through the streets, and rode a horse to show his unaltered physical skills and strength.

Nevertheless, controversy arose.⁶⁴ In fact, certain uneasiness about Succi’s spectacle reached the press. In the eyes of the more sceptical, that public spectacle damaged the authority of local science. The writer and journalist Federic Rahola i Trèmols (1858-1919) published a critical article in *La Vanguardia*, in which he listed all the inconveniences that Succi’s show meant for the city. First, fasting belonged, in his view, to a longstanding unfortunate Spanish tradition caused by economic and religious fanaticism; secondly, fasting was not appropriate for a science pavilion, which was designed to exhibit other kinds of “objective”, “rational” achievements. In Rahola’s own words:

“Please, confess that you have made a mistake: [...]. Your 30 days’ fasting in the midst of textbooks, products of scientific and literary associations, examples of the efforts of science and study in Spain, symbolizes the hardships and fasting to which the unhappy, who focus on scientific speculation and teaching, neglecting bullfighting, politics and stock markets, is condemned.”⁶⁵

Nevertheless, Dr. Benavent concluded that Succi’s case was an excellent example to discard the strict materiality of the human body.⁶⁶ Although enthusiastically encouraging Succi’s public experiment as a crucial practice in modern physiology and nutrition, Dr. Avelino Martín did not share Benavent’s spiritualist,

⁶³ Benavent, *Ayuno Succi*, p. 10.

⁶⁴ “...esclavo de la ciencia y de la observación popular”, “La instalación del hambre”, *La Vanguardia*, 21-09-1888. See also: Federico Rahola, “Carta a Succi”, *La Vanguardia*, 15-10-1888, p. 2.

⁶⁵ “Confesad que os habéis equivocado; ... Esta abstinencia prolongada de treinta días en medio de las obras de enseñanza, de los productos de Asociaciones científicas y literarias, de la muestra de los esfuerzos de la ciencia y del estudio en España, simboliza las privaciones y los ayunos á que viene condenado el infeliz que se dedica á especulaciones científicas y a la enseñanza, desdeñando la tauromaquia, la política y la Bolsa”. Federico Rahola, “Carta a Succi”, *La Vanguardia*, 15-10-1888, p. 2.

⁶⁶ *El Diluvio*, 24-11-1888.

homeopathic approaches to Succi’s resistance. In Martin’s views: “Succi was led to that series of experiments by a totally wrong doctrine. Nevertheless, [he concluded] he is a fanatic of his own ideas. He mixes rationalism and spiritualism...He admits ... the existence of an intrinsic force, susceptible to being transmitted and to influence humans beings”.⁶⁷ In response, Benavent emphatically stressed: “One man, two, eight, twelve, twenty, might be wrong, but several hundreds, is more difficult”.⁶⁸

Succi’s spectacle was for many another “bad” example for the *Palacio de Ciencias* in the context of a peripheral international exhibition, in which the scientific “quality” of the display was often questioned and appropriated by local elites with different political purposes. Beyond the simple amusement of the average visitor in the fair, Succi also brought to the fore deep disagreements in the local context.

5. Flights, lights and other wonders

As Succi left his mark on the local scientific community in terms of the authority of medicine and physiology, other events in the exhibition again questioned the level of local science. In fact, the captive balloon soon became another target for satire and controversy (Figure 5). The balloon was installed inside the exhibition area, in the Ciutadella. It was 22 meters high and 20 meters wide, with two containers of coal gas, and was able to lift a maximum of 18 passengers up to 300 metres high.⁶⁹ It provided a magnificent view of the whole city, as Audouard, the official photographer of the exhibition impressively reported in his pictures.⁷⁰ As advertised in the press, the balloon lifted daily from early morning to night for 5 pesetas per ticket.⁷¹ It was intended to attract as many visitors as possible, complementing other amusements of the fair.⁷² Unfortunately, though, a lightning rod burned the balloon on Saint John's

⁶⁷ “Succi fue impelido a esta serie de experimentos por una doctrina completamente errónea. El, sin embargo, es fanático de sus ideas. Mezcla de racionalismo y espiritismo...Admite ...la existencia de una fuerza intrínseca en ellos, susceptible de transmitirse y actuar sobre el ser humano”, Avelino Martín y Montellá, *El ayuno de Succi...*p. 5.. “Mientras no tengamos Succis, experimentemos en animales, pero cuando se nos presente la ocasión de observar el fenómeno en el hombre rodeado de las precauciones indispensables para alejar la trampa y superchería a que tanto se prestan estas investigaciones, entendemos que el biólogo, que el médico tiene la obligación moral que le impone su carrera de estudiar y de experimentar...”, Martín y Montellá, *El ayuno de Succi*, p. 16.

⁶⁸ “Un hombre, dos, ocho, doce, veinte, pueden equivocarse, muchos cientos, ya es más difícil”, Benavent, *Ayuno Succi*, p. 28.

⁶⁹ *Barcelona y sus exposiciones 1888, 1929*.

⁷⁰ Vallés, *Història gràfica de la Catalunya contemporània*, I, p. 32.

⁷¹ “Globo Cautivo,—Exposición Universal.—Ascensiones diarias, si el tiempo lo permite desde las 6 ½ de la mañana á las 12, y de las 2 de la tarde al anochecer. Ascensiones nocturnas a precios convencionales.—Entrada al recinto del Globo, 0’50 pesetas. Billeto de ascensión, 5 pesetas. NOTA: Recomienda la empresa al público aproveche de las 6 ½ a las 12 de la mañana como las mejores horas para las ascensiones”, *La Vanguardia*, 25-06-1888, p. 2.

⁷² *La Vanguardia*, 20-06-1888, p. 1.

night (23 June), and its replacement had to wait until the end of August, to the great distress and many complaints of visitors.⁷³ The accident was a cause for serious concern in the city. As reported in *La Vanguardia*:⁷⁴

“At 5:15 p.m. an electric spark set fire [to the balloon], destroying it in several minutes. The poor [balloon] ended its days as it lived, tied by a cable. Perhaps it would have done better in liberty. The firm reported the accident with great sorrow, and stated that it had received a telegram from Mr Godard, promising to send another balloon in a few days. In this way the ascensions so loved by the public would resume. The balloon “Spain” is dead. We hope the balloon “Catalonia” will have a longer life. The material costs of the fire came to nine or ten thousand ‘duros’ [5 pesetas]. Only some ropes remained. The spark entered via the valve that opens and closes the gas flow from the meter”.

The accident caused huge technological pessimism, but it also became an excellent opportunity to revisit pro-Spanish and pro-Catalan public addresses, initiated by Almirall and the Catalanist circles some months earlier. The balloon change of name was by no means innocent. But other accidents contributed to further local debates. On the first of November, the popular aeronaut captain J. Huiz Budoy made his last and tragic ascension. After having successfully performed his spectacle at the Plaza de Toros—close to the exhibition area—during the last week of October, Budoy stumbled on a wooden block of his gigantic balloon and fell down to the ground from a considerable height. The block hit some people in the audience and numerous casualties occurred, several of whom were seriously injured and one of whom died. This tragic event added extra uneasiness to that kind of spectacle, calling for more security controls by local authorities.⁷⁵ It was precisely those technological

⁷³ Pich (ed.) *Memòries de Conrad Roure*, IV, p. 122; “Dintre d’un tancat de fustas, sòlidament amarrat, per una corda de cánem que un torn pren y deixa anar, trobém lo Globo cautiu, lluhent, tibat, serio, inflat, balancejantse ab un ayre mitj festí, mitj insultant, que sembla que digui a públich: -¡Que’n sou de petits germans!- Los espectadors que’l miran, se gratan un xic lo cap y esperen que’l mónstruo s’alsi per veure qué passarà. En efecte; ‘l cistell s’ompla ab quinze ó vint ciutadans, y hasta alguna ciueadana; lo jefe fa una senyal, la máquina dona voltes y’l globo’s comensa á alzar. - ¡Qu’és gros!- dihuen las criaturas. ¡Si’s reventés!- pensa un crach. - ¡Expressions als de la lluna! – crida un altre ciudadá. Y’l globo entre tant s’eleva ab tanta solemnitat, que casi sembla un arcalde vestit de pontifical”, Gumà, *Guia Cómica*, pp. 85-86.

⁷⁴ “Era de presumir que fuera víctima de la tormenta el globo cautivo. A las cinco y cuarto una chispa eléctrica le incendió destruyéndole en breves momentos; el pobre ha concluido sus días como vivió, amarrado al cable de retenida. Acaso hubiera salido mejor librado estando en libertad. La empresa, al comunicarnos la noticia, con el sentimiento consiguiente, en el cual la acompañamos, nos dice haber recibido un telegrama de Mr. Godard comprometiéndose a enviar dentro de breves días otro globo igual, con el cual se reanudarán las ascensiones que tanto gusto daban al público. El globo España ha muerto; esperemos que tenga más larga vida el globo Cataluña. Las pérdidas materiales ocasionadas por el incendio del globo, ascienden á nueve ó diez mil duros. No han quedado del globo más que algunas cuerdas. La chispa eléctrica entró por la bálbula que cierra y abre paso al gas, desde el contador”, *La Vanguardia*, 25-06-1888, p. 2.

⁷⁵ “Lo de la plaza de toros”, *La Vanguardia*, 02-11-1888, p. 3.

failures that soon encouraged again public criticism and satire. In his satirical guide of the Exhibition, for instance, Gumà drew a cartoon in which he used the unforgettable experience of looking at the city from 300 metres high to criticise again the whole exhibition project and its low number of visitors, especially during the summer.⁷⁶

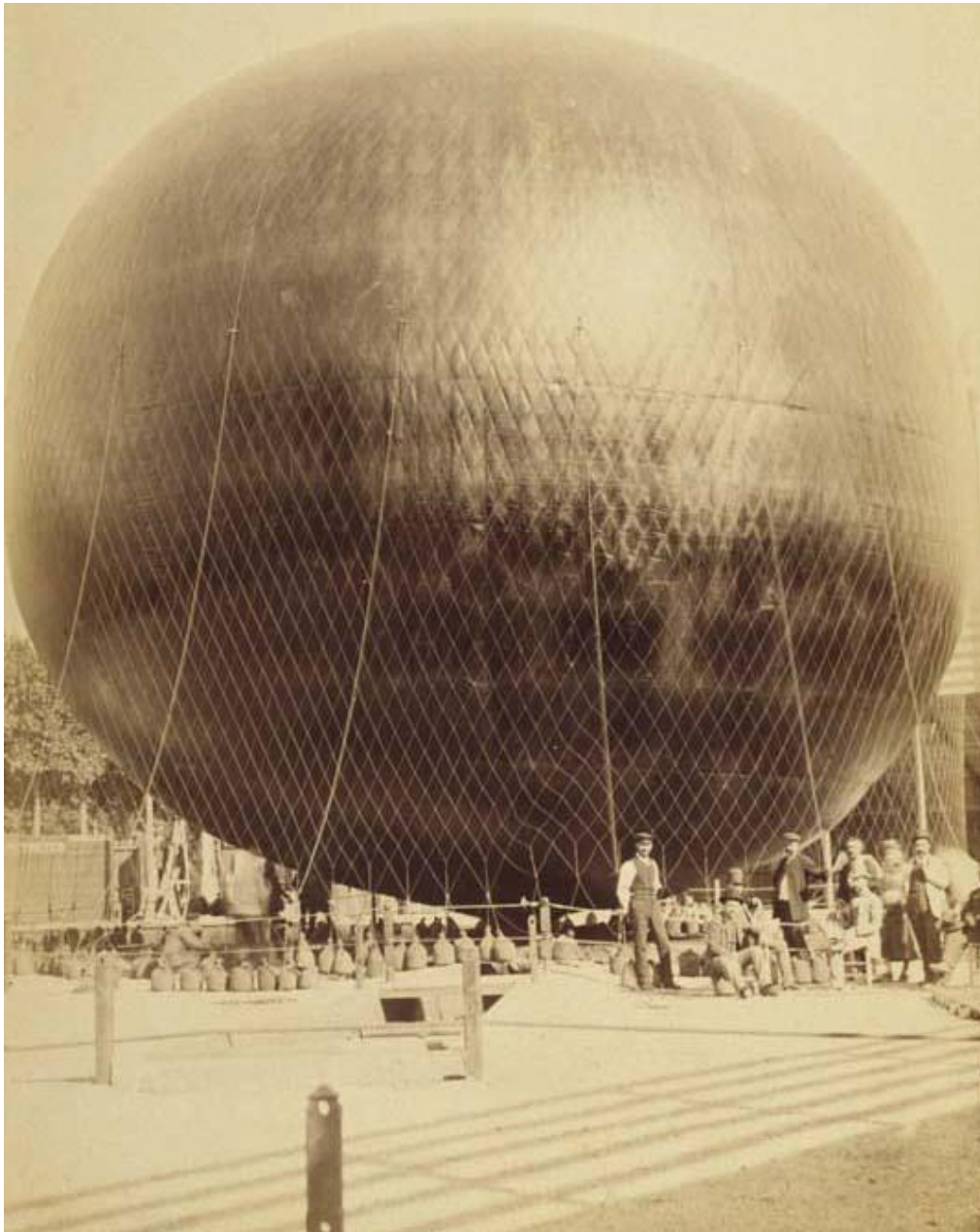


Figure.5 - The Captive Balloon. Arxiu Fotogràfic de Barcelona (AFB) Antoni Esplugas http://arxiufotografic.bcn.cat/es/galeria/exposicion-universal-1888_27_7 free access (last download 21-01-2013).

But all that distress did not hinder the public success of other spectacles of the so called *física recreativa*, which was clearly in between science and spectacle, between

⁷⁶ “- Look from up here we can almost see nothing. It seems that nobody is entering the Exhibition. - Yes, from up here, it seems so, but from down there it is the real truth”, Gumà, *Guia Còmica*, p. 73.

academic physical laws and pure, innocent entertainment. There was, for instance, the case of Miss Thaumata – half human, half dummy –, Miss Stella with her head appearing in the centre of a flying star, and the impressive jump of Canon Woman. Miss Stella's head was also used to produce spectacular effects in a black chamber known as *Metempsychosis*,⁷⁷ the latter being described in the press as follows:

“At the end of a dark chamber there is a cardboard bust that looks like plaster: like one of the numerous models for drawing antiquities. A lateral beam of light shines on it. Suddenly, the bust slowly comes to life. Its pores ooze with life and colour, flesh filters through the cardboard and a set of sparkling eyes appear in the bowls: it is indeed Miss Stella's head”.⁷⁸

All of this was complemented by other impressive visual spectacles, which challenged optical principles and human perceptions: the panoramas. Often associated with world fairs, the panoramas progressively became a fashionable urban spectacle throughout the nineteenth century. They consisted of circular painted fabrics measuring roughly 100 meters long by 10 meters high, displayed in temporary cylinder-like buildings in a trompe-l'oeil shape. Zenithal lighting helped spectators to get an impression of three-dimensional reality from an elevated central viewpoint. Visitors placed themselves in the centre of a circular enclosure, the walls of which were completely painted, together with a set of real objects placed closer to the audience and illuminated by the zenith.⁷⁹ In those optical experiments of the “pre-cinema” age, renowned realist painters and sculptors described details of famous battles, natural landscapes and other famous historical events.⁸⁰

During the exhibition, three panoramas were installed in the city.⁸¹ Designed by local artists, the Panorama Montserrat, on the back wall of the Palacio de Bellas

⁷⁷ Josep Yxart, *El año pasado. Letras y Artes en Barcelona* (Barcelona: Librería española de López, 1889), pp. 351-352.

⁷⁸ “En el fondo de una cámara oscura está el busto de cartón figurando yeso: como uno de tantos modelos para el dibujo de lo antiguo. Un rayo de luz lateral le alumbra. De pronto, el busto se anima lentamente, rezuman sus poros de vida y color, se filtra a través del cartón la carne, y en los cuencos asoman unos ojos que chispean: es la misma cabeza de la Señorita Stella...”, Yxart, *El año pasado*, pp. 351-352.

⁷⁹ Vallés, *Història gràfica de la Catalunya contemporània*, I, p. 196.

⁸⁰ Neus Moyano, “El panorama Waterloo a Barcelona (1888-1890), *L'Avenç*, 2008, 334: 42-49. See also: Jordi Artigas Candela, “La febre dels panoramas a la Barcelona de la fi del segle XIX”, in *L'origen del cinema i les imatges del segle XIX* (Girona: Fundació Museu del Cinema, 2001), 121-140.

⁸¹ “Panorama de Plewna.— Granvía — Abierto de día y noche. Entrada, 1 peseta...Gran Panorama de la Batalla de Waterloo.—Situado en la Plaza de Cataluña, uno de los lienzos más grandes del mundo, pintado por el célebre Verlat; esculturas y estatuaria del eminente Mr. Joris—Entrada 1 peseta.—Abierto al público desde las 8 de la mañana á las 7 1/2 tarde. Montserrat.—Panorama Dinorámico.— Recinto de la Exposición, al lado del Palacio de Bellas Artes.—Abierto desde las 9 de la mañana hasta las 11 de la noche, iluminado con luz eléctrica. Entrada 1 peseta. Durante las horas que está cerrada la Exposición, la entrada es por el Paseo de la Industria”, *La Vanguardia*, 25-06-1888, p. 2.

Artes in the exhibition area, used electric light; the Panorama Plewna, on the corner of Gran Via and Plaça Universitat, commemorated a battle between Russia and Turkey in 1877–78;⁸² and finally, the Panorama Waterloo, at Plaça Catalunya, reconstructed the famous battle with drawings by the French painter Paul Philippoteaux (1846–1923).⁸³ This latter panorama, which received almost 200,000 visitors in four months, had already been exhibited in 1885 in Anvers (Belgium) on a 120 x 15 meter canvas of delightful paintings by Charles Verlat with 300 statues by the sculptor Franz Joris.⁸⁴

Electricity provided other fascinations. The exhibition became an ideal event to place the electricity applications explicitly in the public sphere, as a way of transmitting sounds, as a new source of power for electric motors, and as a lighting alternative to gas.⁸⁵ Electricity played an important role in the *Galería de máquinas* with electric motors, voltaic arcs, and incandescent lamps,⁸⁶ but was also fundamental for the visitors’ amusement.⁸⁷ This was not an exception in Barcelona. As Iwan Rhys Morus clearly expressed: “Throughout the nineteenth century...electricity provided the technology for a whole range of vivid and spectacular demonstrations of nature’s powers, and of man’s powers over nature... [it] was very much about making this new power spectacularly visible and making it useful too”.⁸⁸ In fact, electrical lighting had already been used in former exhibitions in the UK, in London, Manchester, and Glasgow. In Paris, in 1881, incandescent lamps were shown for the first time at a large scale in the electrical exhibition which took place in the city.⁸⁹ So, back in Barcelona, electric lights accompanied numerous public events: in the maritime exhibition, parade ships were illuminated with electric lights; in the “arco-cascada” at the Plaça Catalunya; in the *Palacio de la Industria*; but also in the popular magic

⁸² It was substituted in the same place in 1889 by the Panaroma of the Paris siege.

⁸³ *Panorama de la batalla de Plewna, librada el 28 de noviembre de 1877: reseña histórica, pintado por M. Pablo Philippoteaux* (Barcelona: Imp. de Luís Tasso Serra, [18--?])

⁸⁴ Neus Moyano, “El panorama de Waterloo a Barcelona (1888-1890)”.

⁸⁵ “Las diversas aplicaciones de la electricidad, empleada como medio de transmisión de sonidos, como fuerza y como luz, que diariamente nos sorprenden, así como los perfeccionados aparatos que se inventan o modifican, auxiliares poderosos de la física y de la química, podrán estudiarse en el Palacio de ciencias...”, García Llansó, “La Exposición Universal de Barcelona”, *La Ilustración*, 1888, 390: 262-263. On the public role of electricity in early nineteenth London, see: Iwan Rhys Morus, *Frankenstein’s Children. Electricity, Exhibition, and Experiment in Early Nineteenth-Century London* (Princeton: University Press, 1998).

⁸⁶ Valero de Tornos, *Cuarenta Cartas*, pp, 245-247.

⁸⁷ Pich (ed.) *Memòries de Conrad Roure*, IV, pp. 122-123.

⁸⁸ Iwan Rhys Morus, *When Physics Became King* (Chicago: The University of Chicago Press, 2005), p. 86.

⁸⁹ John W. Stamper, “The Galérie des machines of the 1889 Paris World’s Fair”, *Technology and Culture*, 1989, 30(2): 330-353.

fountain, which was installed in the old arms square of the Ciutadella where its three dynamo electric elements provided fascinating colour changes for the audience.⁹⁰ It was precisely for the celebration of the *verbenas* in June that the enclosure of the exhibition was illuminated for the first time with electric lighting replacing gas lighting.⁹¹ Electric lighting was also used in the night parties at the maritime exhibition, an area that was connected to the Ciutadella by means of the Eiffel-like iron bridge. It also illuminated the *Palacio de la Industria* pavilion and Plaça Catalunya.⁹² The ideal “electric tour” of the Exhibition, with more than 2,000 Edison electric lamps, passed through the Ramblas, Passeig Colom (Hotel International), the exhibition, and inside it, the magic fountain and the night celebrations at the maritime display (Figure 6).⁹³ Gumà also reflected with great enthusiasm on those “new machines”, with no flame, gas or oil, which cannot be blown out.⁹⁴

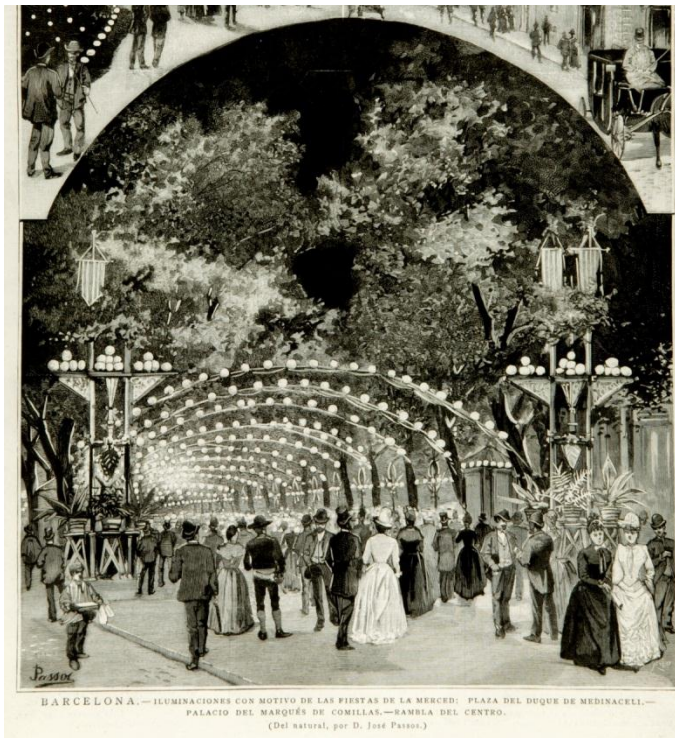


Figure 6 - Electric lighting in the city. *La Ilustración. Revista Hispanoamericana*, 1888, 397 (front page).

⁹⁰ Lacal, *El libro de honor*, pp. 91-94.

⁹¹ Pich (ed.) *Memòries de Conrad Roure*, IV, p. 123.

⁹² Lacal, *El libro de honor*, p. 93-94.

⁹³ Duran i Bas quoted by Carlos Pirozzini (28-06-1888): “...debería intentarse, con invitación al efecto, que iluminasen sus edificios, no sólo la Transatlántica y demás que se levanten dentro de la Sección Marítima, sino los externos a la Exposición pero contiguos a ella”, Carlos Pirizzini correspondence. Ms 5031-I. Biblioteca de Catalunya. Barcelona.

⁹⁴ “Això que están mirantse es lo lloch on se fabrica aquest llum que no fa flama, ni té blé, ni es de gas, ni es oli, ni bufant pot apagarse....!Son las máquinas eléctricas! ¿Veuhén? Edison. No falla: aquest nom ho diu clá y net. Toquéu pipa á pas de marxa, que allí hont hi ha electricitat es fácil electricisarse!”, Gumà, *Guia Cómica*, pp. 38-39.

On 9 of December 1888, a “procesion cívica” with representatives of all the nations taking part in the Exhibition celebrated the closing ceremony at the *Palacio de Bellas Artes*. Later, the whole procession went to the entrance of the *Palacio de la Industria*, where the *Comisario Regio* formally closed the exhibition. The towers of the *Palacio de la Industria* were illuminated with “luces de bengala” (fireworks), and a choir and orchestra played the *Himno a la Exposición* (the Exposition hymn). Then there were fireworks and the entire city was illuminated.⁹⁵

There is no doubt that the public was fascinated by electric light, but local experts’ accounts again expressed skepticism. The professor of electricity Antonino Suárez Saavedra considered that the electricity displays at the exhibition were not particularly brilliant.⁹⁶ In his view, electricity was already a déjà-vu at the exhibitions in 1888 and Barcelona inevitably suffered from a peripheral position in terms of the electrical novelties that were already designed for Paris 1889. He did, however, praise the *Sociedad Española de Electricidad* for its significant contribution to the lighting of several palaces and gardens, together with the magic fountain. His conclusions were compelling: “In electricity. . . . a lot good and few new”.⁹⁷ Significantly, even one of the most glamorous manifestations of the fair could not escape controversy.

6. Amazing animals

At the exhibition, the *Museo de Ultramar* displayed a magnificent zoological collection from the Philippines.⁹⁸ The aquarium also became another very popular site in which a collection of animals was exhibited, divided into seven different sections in 14 showcases of reptiles, amphibians, fish, molluscs, crustaceans and insects.⁹⁹ But the main collections were displayed outside the exhibition ground:¹⁰⁰ the *Museu del Comte de Belloch* held an important zoological cabinet on Passeig de Gracia.¹⁰¹ In April 1888, the Redemback collection on Gran Vía included an elephant ringing a bell and a rich

⁹⁵ *La Ilustración*, 1888, 420: 751.

⁹⁶ Antonino Suárez Saavedra, “La electricidad en la Exposición Universal de Barcelona”, in *Ateneu Barcelonés, Conferencias públicas relativas a la Exposición Universal de Barcelona*, pp. 378-400.

⁹⁷ Suárez Saavedra, “La electricidad en la Exposición Universal de Barcelona”, p. 401.

⁹⁸ Pich (ed.) *Memòries de Conrad Roure*, IV, p. 100.

⁹⁹ “La tarde en la Exposición: El aquarium”, *La Vanguardia*, 02-07-1888, p. 2.

¹⁰⁰ Pich (ed.) *Memòries de Conrad Roure*, IV, p. 120-121

¹⁰¹ Valero de Tornos, *Guide Illustré de l’Exposition*, p. 60

collection of monkeys. It was advertised as “the most numerous and varied collection of wild animals in Barcelona”.¹⁰²

In August, Jean-Baptiste Bidel’s collection was displayed on Passeig de Gràcia with wild animals, some in cages and a spectacular camel. Bidel’s collection contained live lions, tigers, panthers, leopards, hyenas, elephants, camels, monkeys.¹⁰³ It became a very popular, “bad smelling” scientific curiosity (Figure 7).¹⁰⁴ Josep Yxart reported on a “Noah’s Ark” full of live animals in its tour of the Rambla, and remarked on the amazing amount of wild animals and zoological collections across the city.¹⁰⁵ He imagined a real parade of animals through the city with monkeys, cats, dogs, bears, panthers, tigers, lions, elephants, camels, and giraffes, together with the equestrian circus at Plaça Catalunya.¹⁰⁶



Figure 7 - Bidel’s collection of live animals in an earlier visit to Barcelona in 1877, *La Campana de Gràcia*, 26-08-1877, p. 5.

¹⁰² “Redenbach.— La más numerosa y variada colección de fieras que hay en Barcelona. Abierta desde las 8 de la mañana á las 12 de la noche. Exposición Zoológica de Mr. Cavatinas - Plazade Cataluña.— Las más hermosas fieras de todas clases Funciones ejecutadas por perros, cabras y monos amaestrados. A las 5 de la tarde y á las 9 de la noche, Entrada general, 2 reales”, *La Vanguardia*, 25-06-1888, p. 2

¹⁰³ *Catálogo de la Exposición zoológica de Mr. Bidel* (Barcelona. Tipografía de Oliveres, c. 1885)

¹⁰⁴ “...olor nauseabundo que emanaba del estiércol de tantos animales como había encerrados en las reducidas dimensiones de la barrera”, Pich (ed.) *Memòries de Conrad Roure*, IV, p. 121.

¹⁰⁵ “Seguirá a esta sección de animales vivos, la extravagante y siniestra de los seres inanimados, las figuras de cera ... y la artillería y caballería de cartón de los panoramas de Plewna y Waterloo”, Yxart, *El año pasado*, p. 91.

¹⁰⁶ Yxart, *El año pasado*, pp. 87-89.

Beyond the exhibition walls, those private collections of wild animals (colecciones de fieras) constituted an appealing urban route for local citizens and foreign visitors. This was part of a complex process, from the early-modern times of menageries, in which the private collection of animals in a cabinet de curiosités-like style represented wealth and social prestige and power, to the nineteenth century displays of live animals, which progressively became commodities, while at the same time, the animals become marginalised for everyday life.¹⁰⁷ In addition, beyond the academic walls, this was the time to give voice to different groups of amateurs in civic settings such as museums, schools, and zoos, but also in shows of private collections on the street, contributing to a more “populist” natural history.¹⁰⁸ From 1830 to 1880 an increasing number of popular travelling animal shows and circuses progressively contributed to the establishment of public zoos. In those sites, scientific research, conservation and colonial values, domestication of animals, and the amusement and education of urban citizens coexisted in complex ways that should be carefully explored in every local context.¹⁰⁹

The “animal culture” in Barcelona even took other forms. A camel from Bidel’s collection joined the parade for the opening ceremony of the Columbus Monument on 19 October 1888. Curiously, the Columbus Monument was surrounded by eight impressive statues of wild lions in a relaxed state of calm in contrast with the excitement of the live lions, cruelly whipped in Bidel and Redenbach’s collections. In those busy days of the exhibition these eight lions became a material symbol of the controversy between domesticated and wild animals, in the midst of that populist natural history that was spreading across the city.¹¹⁰ In addition, stuffed animals were kept at the Martorell Museum, a building in the heart of the Ciutadella, in a very convenient setting between the *Hivernáculu* and the *Umbráculu* in the exhibition area. The Museum was set up using the donations of the private collection of Francesc Martorell Peña (1822-1878) in 1878. It held an important

¹⁰⁷ R. J. Hoage, William A. Deiss (eds.) *New Worlds, New Animals. From Menagerie to Zoological Parks in the nineteenth century* (Baltimore: The Johns Hopkins University Press, 1996); Nigel Rothfels, *Savages and Beasts. The Birth of the modern Zoo* (Baltimore: The Johns Hopkins University Press, 2002). See also: Lynn K. Nyhart, *Modern Nature. The Rise of the Biological Perspective in Germany* (Chicago: University of Chicago Press, 2009).

¹⁰⁸ Nyhart, *Modern Nature*. pp. 1-34.

¹⁰⁹ Sally Gregory Kohlstedt, “Reflections on Zoo History”, in R. J. Hoage, William A. Deiss (eds.) *New Worlds, New Animals*, p. 6.

¹¹⁰ “...su autor no tiene la culpa de haber hecho a esos felinos tales como deben ser, y son realmente en sus horas de calma, y no tales como se los figura el vulgo por haberlos observado al natural hostigados por el látigo de Bidel o de Redenbach”, *Estudios sobre la Exposición Universal de Barcelona inaugurada en 20 de mayo y cerrada en 9 de diciembre de 1888* (Barcelona: Establecimiento tipográfico del Diario Mercantil. 1888), p. 113.

collection of vertebrate and invertebrate animals, together with fossils, as well as more than 12,000 minerals.



Figure 8 - The Columbus Monument and its lions. *La Ilustración Española y Americana*, 1888, 35: 168.

All those private collections of animals, public shows and early museums probably “preceded” — as the panoramas preceded the cinema — the foundation of the Barcelona Zoo in 1892, under the direction of the naturalist and taxidermist Francesc Darder (1851-1918). The initial collection of 36 mammals, 123 birds and 2 reptiles was soon increased with the purchase of the private collection of Luis Martí Codolar (? – 1915).¹¹¹ In 1899, Darder opened his *Museo Zootécnico* in the zoo, with new sections of comparative anatomy, embryology, hunting and fishing, a library and a reading cabinet. It also included an industrial area for the applied natural history that Darder extensively practiced.¹¹²

In spite of causing fears and bad smells, in a way, the 1888 Barcelona Exhibition became a huge display of wild and tame animals. They were displayed in public and private spaces, and raised great interest but also controversy: from exoticism and wilderness to domestication and control, from canonical examples of struggle for life to paradigms of human control on nature and society.

¹¹¹ *Anuario Estadístico de la Ciudad de Barcelona* (Barcelona: Imprenta de Henrich, 1902), p. 259.

¹¹² *Anuario Estadístico de la Ciudad de Barcelona*, pp. 309-10.

7. Conclusion

As several of the former examples have shown, this is a preliminary attempt to place the 1888 Barcelona International Exhibition in the broader framework of an urban history of science. For that purpose, I have tried to prove that this exceptional event has to be analysed as a complex manifestation of the city as a whole, beyond the restricted area of the Ciutadella: from maritime fireworks to Succi’s tour through the city centre, from the Columbus parade for the inauguration of the monument to the richness of animal displays in the exhibition grounds and along the *Ramblas*; from the fascination of the captive balloon to the popular Plewna and Waterloo panoramas; from electric lights at the impressive *Palacio de la Industria* to the lighting of the city streets.

In a similar vein, the paper has put a special emphasis on controversy and disagreement rather than on consensus. It has tried to overcome the legitimating account that we often find in official guides and public addresses to explore further the plurality of expert and lay perceptions. These are for instance the cases of Almirall versus Valero de Tornos; working-class voices at *El productor* confronting the conservative discourses of elites at the *Diario de Barcelona*; support of Succi’s fasting by Dr Benavent and medical reluctance’s by Dr Martín; praise of foreign luminaries on the walls of the exhibition palaces, contra claims of local inventors’ dignity; Catalan versus Spanish nationalism. In addition, the paper has also examined significant aspects of the political dimension of the Exhibition, which was often linked to science. Scientific progress or backwardness was used to legitimise particular political positions, from left to right, from Catalanism to the reinforcement of the central Spanish authority.

Going back to the already mentioned connections between science and the city, the 1888 Barcelona case and the micro cases sketched here might enrich the general framework of the aforementioned *Osiris* volume. Deep intersections between scientists, inventors and politicians contributed to the emergence of a local *urban expertise*. Assessing the scientific quality of the objects exhibited, local elites argued about the political, economic progress and the backwardness of the nation. Balloons, electric lights and sparks, parades, animal displays, panoramas, clearly contributed to the making of a *cultural representation of the city*. Walking through the city of Barcelona in 1888, a significant set of *places of knowledge* could be identified; the conference room at the science pavilion, the panoramas, the magic fountain, or Escuder boule, among many others, became significant places and sites to stimulate

scientific controversy and circulation of ideas. Finally, visitors and their plural views on science and progress provide us with valuable data on the *scientific culture of the everyday life*.

In a way, the 1888 Barcelona International Exhibition as a whole can be considered as a very rich primary source to write the urban history of science of the city of Barcelona at the end of the nineteenth century, an ambitious endeavour, which I hope to be able to develop in depth in future publications.

Scientific–medical knowledge management through media communication practices: a review of two opposite models in early 20th century Spain

*Carlos Tabernero**, *Isabel Jiménez-Lucena***, *Jorge Molero-Mesa**

Abstract

This paper explores the complex relationship between two sets of practices and discourses that are essential constituents of the processes of construction and functioning of contemporary societies: medicine-health and mass media. Two context-linked and overtly contrasting case studies help illustrate the intricate dynamics of scientific-medical knowledge management, that is, from its generation and circulation to its appropriation, as articulated through mass media: first, the Spanish libertarian movement strategies of re-signification of officially sanctioned medical-health knowledge as conveyed in a medical Q&A section of a 1930s Spanish anarchist magazine; and second, the use of medical-health policies, as applied to colonial settings and portrayed through documentary films, as a crucial element for the legitimizing strategies of Franco's fascist regime in the 1940s. By pondering them jointly, and owing to the radical opposition of the approaches to knowledge management they represent, we show the application of a combined theoretical framework to tackle these processes. On the one hand, the multidimensional, social and professional inclusion-exclusion dynamics involved in the construction and circulation of scientific-medical knowledge is considered. On the other, the communication practices and discourses that are conducive of these dynamics are explored.

Keywords: scientific-medical knowledge management, inclusion–exclusion, communication practices, anarchist press, francoist medical-colonial documentaries.

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1. Medical-health knowledge and mass media

The experience of illness constitutes an integral part of people's biographies and everyday lives. It might be argued that it is hardly visible as it typically stays in the private sphere, either in the strict individual terms of each person's dwellings, work circumstances, family and acquaintances, or within the realm, when available, of the relationship between doctors and patients. However, it is through this relationship, as held within a given health system, as well as through people's interactions in the social domain, notwithstanding other epidemiological factors, that *illnesses*, understood as an individual's utter sufferings that lead to an impossibility to live life to the full, may eventually start becoming *diseases*, namely, publicly and/or officially recognized morbid species, and *sicknesses*, that is, with clear-cut social, political and cultural dimensions¹. Indeed, we may further argue that the differentiation between these terms is based upon distinct levels of visibility, where individual experiences of illness may ultimately turn into a collective experience of disease. Given the strategic importance of such experiences, such processes necessarily require the contribution of an array of practices and discourses, which lie, in turn, at the heart of the social, political and cultural scaffolding of human communities.

This paper focuses on the complex relationship between two sets of practices and discourses that are indeed essential constituents of the processes of construction and functioning of contemporary societies: medicine-health and mass media. The take of modern medicine on processes of health and disease importantly involves the designing and building of health systems and the implementation of public health policies. These systems and policies inescapably shape, among other aspects, the abovementioned individual experience of illnesses as well as the relationship between doctors and patients. Indeed, Public Health, as a set of institutionalized, health-related structures, practices and discourses that have become ever-present in people's everyday lives, is a key constituent of the construction and management of the ways that people, individually and collectively, perceive and experience health and disease. Hospitals, health centres and surgeries have become, through the processes of institutionalization and professionalization of medical practices in the last two centuries, common background features of the landscapes of contemporary societies. The practices that take place and are prescribed in these venues as well as the

¹ Eisenberg L. (1977) "Disease and illness: distinctions between professional and popular ideas of sickness". *Culture, Medicine and Psychiatry* 1(1): 9-23, as discussed in: Tabernero, Carlos; Perdiguero, Enrique (2011) "Cinema and the collective dimensions of disease". *Journal of Medicine and Movies* 7(2): 44-53.

discourses that are generated and used in and around them, either separately or as State comprehensive health policies, contribute to make disease visible to the community. In addition, all these processes, given their undeniable significance, play a decisive role in the construction of identity, at individual, physical, social and cultural levels².

We hope to contribute to the historical understanding of largely multi-layered (i.e. shared by experts and non-experts) processes of generation and management of scientific-medical knowledge and their impact, above all when articulated through mass media, on patterns of socio-cultural transformation.

Mass media also play a central part regarding, among many other aspects, the visibility of disease and its role in the shaping of individual and community identity. Largely during the last two centuries, as happened with medicine, the mass media have grown to be an essential set of practices and discourses for the construction and consolidation of contemporary societies. They constitute one main source of wide-ranging representations and interpretations of the values, projects, concerns and expectations of each human community. Their use contributes to the formulation of the symbolic framework on which the social, economic, political, ethical and cultural life is built and sustained. And in addition, owing to the mounting presence of mass media in everyday life activities, their appropriation entails the shaping of the spatial and time experience, perception and organization of people's lives within those communities. Thus, from the point of view of people's perception and experience of health and disease, mass media play a necessary and complementary role to and for the Public Health system, its venues, policies, practices and discourses³.

Recent developments and debates in many different fields addressing the mechanisms of construction and circulation of knowledge in contemporary societies have focused on exploring and questioning the assumption of a vertical, unidirectional diffusion model of knowledge management⁴. For instance, taking medicine and

² See, for instance: Andrew Wear (ed.), *Medicine in Society* (Cambridge: Cambridge University Press, 1992); Ilana Löwy; John Krige (eds.), *Images of Disease: Science, Public Policy and Health in Post-war Europe* (Luxembourg: Office for Official Publications of the European Communities, 2001); Ballard, Karen; Elston, Mary A. (2005). "Medicalisation: A Multi-dimensional Concept". *Social Theory and Health* 3: 228-241. And also: Stanley Aronowitz, *Science as Power. Discourse and Ideology in Modern Society* (Minneapolis: University of Minnesota Press, 1988); Mark Walker, *Science and Ideology. A Comparative History* (London: Routledge, 2003).

³ Clive Seale, *Media and Health* (London: Sage, 2004); Lester D. Friedman (ed.), *Cultural Sutures: Medicine and Media* (Durham, N.C.: Duke University Press, 2004).

⁴ Alan Irwin; Brian Wynne, *Misunderstanding Science? The Public Reconstruction of Science and Technology*, (Cambridge: Cambridge University Press, 1996); Secord, James A. (2004). "Knowledge in Transit". *Isis* 95: 654–672; Massimiano Bucchi; Federico Neresini, "Science and public participation". In: E. J. Hackett, O. Amsterdamska, M. Lynch and J. Wajcman (eds). *The Handbook of Science and Technologies Studies* (Cambridge, MA: MIT Press, 2008), pp. 449-472; "Focus: Historicizing 'Popular Science'". (2009). *Isis* 100(2): 310-368;

Public Health, on the one hand, and mass media, on the other, in a deliberately broad sense as sets of ‘practices and discourses’, as we have insistently so far referred to them both, implies acknowledging explicitly their condition as forms of everyday action and interaction among individuals, groups and institutions within the socio-cultural framework of human communities. This involves, importantly, mechanisms of creation, circulation and management of knowledge (specifically medical/health-related), which are utterly fundamental, precisely, for the processes of construction, legitimation, functioning and consolidation of contemporary human communities. In this sense, as we focus on the processes of popularization of scientific knowledge, it is traditionally assumed (and applied or as a rule at least attempted, even arguably in the current age of the Internet) that knowledge is vertically transmitted from the few experts that create it or facilitate its generation and then circulated to the many purportedly passive, non-participant, submissive and dependent non-experts⁵. Hence, it has become necessary to tackle the processes of science, medicine and technology popularization from a combined perspective that takes into account power relations and their embedding in people’s everyday lives.

This paper is a review of the joint application of two theoretical and methodological approaches that consider (a) inclusion–exclusion dynamics which are conducive of processes of validation of authority and the associated knowledge production⁶; and (b) the communication practices and discourses that contribute to these dynamics⁷. In order to do this, we use our own experience applying them jointly to two specific, contrasting and context-linked case studies related to medical-health knowledge, practices and discourses as put across through mass media. On the one hand we consider the strategies of re-signification of officially sanctioned medical-health knowledge and its articulation through the redefinition of people’s participation in knowledge management processes, as conveyed in a medical Q&A

Agustí Nieto-Galán, *Los públicos de la ciencia. Expertos y profanos a través de la historia* (Madrid: Marcial Pons, 2011).

⁵ John B. Thompson, *The Media and Modernity. A Social Theory of Media* (Cambridge: Polity Press, 1995); Taberner, “Cine y procesos de medicalización”. The experts, in the case of medical-health knowledge and its articulation through media, would mostly be scientists, physicians, professors, policy-makers, producers, editors, distributors, companies and institutions. Conversely, the non-experts would mostly be patients, users, customers, students, readers, listeners, viewers, or the population at large.

⁶ Cornelia Bohn, “Inclusion and exclusion: Theories and findings. From exclusion from the community to including exclusion”. In: A. Gestrich, L. Raphael and H. Uerlings (eds.) *Strangers and Poor People. Changing Patterns of Inclusion and Exclusion in Europe and the Mediterranean World from Classical Antiquity to the Present Day* (Frankfurt: Peter Lang, 2009), pp. 35-54.

⁷ Couldry, Nick (2003) “Review Article: Everyday Life in Cultural Theory”. *European Journal of Communication* 18(2): 265-270; Couldry, Nick (2004) “Theorising Media as Practice”. *Social Semiotics* 14(2): 115–32; Birgit Bräuchler and John Postill, *Theorising Media and Practice* (Oxford/New York: Berghahn, 2010).

section of a 1930s Spanish anarchist magazine⁸; and, on the other, the use of medical-health policies, as applied to colonial settings and portrayed through documentary films, a significant element within the legitimating strategies of Franco's fascist regime in the 1940s, aiming at disciplining the population⁹.

2. Authority and resistance

Focusing on processes of power implies the need to look at knowledge management, among other aspects, from the perspective of inclusion–exclusion dynamics. Inclusion–exclusion dynamics in contemporary societies are complex, multidimensional processes where wide-ranging social, economic, political and cultural factors combine to produce the patterns of classification and rationalization of distinct human clusters upon which a given community is built and functions. Scientific-technological practices and discourses, and especially when related to medical-health concerns, as basic constituents of western hegemonic thought, undoubtedly play a fundamental role in these processes. In this sense, regarding medical-health practices and discourses, we must examine the development of processes of (de)medicalization, as assimilation and resistance to hegemonic principles and values taking place as a concurrent dynamics. The abovementioned assumption that medicalization as a lineal, unidirectional process of inescapable *imperialist* domination on the part of mainstream science and medicine, is utterly insufficient from an analytical point of view. Such perspective implies the consideration of knowledge management endeavours in a non-problematic way (even when resistance is framed in a rather one-dimensional dichotomy of opposites), while it has become clear, as described, that these are complex, multi-layered and multidimensional

⁸ Molero-Mesa, Jorge; Jiménez-Lucena, Isabel (2013) “‘Simpatía por los manuales’. Las dinámicas de inclusión-exclusión en torno a la profesión médica y el anarcosindicalismo español en el primer tercio del siglo XX”. *Dynamis* 33(1) (in press); Tabernero, Carlos; Jiménez-Lucena, Isabel; Molero-Mesa, Jorge (2013) “La redefinición de la participación en el movimiento libertario en la España del primer tercio del siglo XX: la sección ‘Preguntas y respuestas’ (1930-1937) de la revista *Estudios*”. *Dynamis* 33(1) (in press); Jiménez-Lucena, Isabel; Molero-Mesa, Jorge (2011) “Good birth and good living. The (de)medicalising key to sexual reform in the anarchist media of inter-war Spain”. *International Journal of Iberian Studies (IJIS)* 24(3): 219-241; Carlos Tabernero, “La sección ‘Preguntas y Respuestas’ de la revista anarquista “Estudios” (1930-1937): generación y gestión multidimensional de conocimiento científico-médico”. In: Porras Gallo M.I., et al. (eds.) *Transmisión del conocimiento médico e internacionalización de las prácticas sanitarias: una reflexión histórica* (Ciudad Real: SEHM y Universidad de Castilla-La Mancha, 2011), pp. 407-411.

⁹ Carlos Tabernero; Isabel Jiménez-Lucena; Jorge Molero-Mesa, “Film, medicine and empire: inclusion-exclusion practices and discourses in Spanish medical-colonial documentaries of the 1940s”. In: Roca-Rosell A. (ed.) *The Circulation of Science and Technology. Proceedings of the 4th International Conference of the ESHS* (Barcelona: SCHCT-IEC, 2012), pp. 1159-1165; Carlos Tabernero, “Cine y procesos de medicalización: documentales médico-coloniales de la posguerra española (1946-1949)”. In: Antonin M., Brigidi S. (eds.) *Cultura, Salud y Cine* (Bellaterra, Barcelona: EUI Gimbernat - Universidad Autónoma de Barcelona, 2012, in press); Carlos Tabernero, “El proceso salud-enfermedad como instrumento del discurso hegemónico en el cine español de la posguerra (1939-1950)”. In: Ortiz Gómez T., et al. (eds.) *La experiencia de enfermar en perspectiva histórica* (Granada: Universidad de Granada, 2008), pp. 361-365.

processes, where hegemonic and counter-hegemonic lines of thought are necessarily intertwined¹⁰. Health-medical-driven, positivist and biology-based control and disciplining (*colonizing*) of people's bodies has been and is constantly negotiated, assimilated and resisted, by distinct active agents through complex sets of practices and discourses. Such negotiations take place beyond the strict limits of the scientific and medical realms, entering the political, economic, social and cultural milieus of human communities. Moreover, they occur mostly through dynamic processes of re-signification concerning scientific-medical knowledge, and of redefinition of participation (of distinct groups) in the management of this kind of knowledge (among others). This opens the possibility for different kinds of biopolitics, including those where the apparently incontestable techno-scientific normalizing of social clusters is counteracted through the outlining of a completely different view of nature (see below). Such different biopolitics also need the input of scientific-medical professionals, which would not be devoid of conflict, as it would aim at the generation of alternative sets of discourses and practices¹¹.

Bearing this in mind, and as shown by recent historiography, it should not come as a surprise that science and medicine were also fundamental for the development of libertarian thought. A close examination of the Spanish anarchist movement of the first third of the 20th century reveals complex medicine–health-related inclusion–exclusion strategies, mainly related to medical professionals, albeit certainly concerning all actors involved in the management of these practices and discourses. Indeed, the construction of an anarcho-syndicalist model in Spain at that time entailed guaranteeing the independence of the unions, which meant, among other aspects, preventing intellectuals or professionals of any political and ideological stripe (including anarchists) from imposing a line of action on the rank and file. Anarchist trade unions did not accept the techno-scientific imperative that deemed intellectuals or professionals as the best suited to make decisions concerning the community. Regarding medical experts in particular, anarchists were carrying out a

¹⁰ Ballard and Elston, “Medicalisation”. Kusiak, Pauline (2010) “Instrumentalized rationality, cross-cultural mediators, and civil epistemologies of late colonialism”. *Social Studies of Science* 40(6): 871-902; Medina-Doménech, Rosa M. (2009) “Scientific technologies of national identity as colonial legacies: Extracting the Spanish nation from Equatorial Guinea”. *Social Studies of Science* 39(1): 81-112.

¹¹ Jiménez-Lucena and Molero-Mesa, “Good birth and good living”; Isabel Jiménez Lucena; Jorge Molero-Mesa, “Problematizando el proceso de (des)medicalización. Mecanismos de sometimiento/autogestión del cuerpo en los medios libertarios españoles del primer tercio del siglo XX”. En: Marisa Miranda; Álvaro Girón-Sierra (eds) *Cuerpo, biopolítica y control social: América Latina y Europa en los siglos XIX y XX* (Buenos Aires: Siglo XXI, 2009), pp.69-93; Jorge Molero-Mesa; Isabel Jiménez Lucena, “‘Otra manera de ver las cosas’. Microbios, eugenesia y ambientalismo radical en el anarquismo español del siglo XX”. In: Gustavo Vallejo; Marisa Miranda (eds.) *Derivas de Darwin. Cultura y política en clave biológica* (Buenos Aires: Siglo XXI, 2011), pp.143-164.

profound critique of bourgeois health improvement approaches and strategies, that is, of the techno-scientific-based capitalist modernity–coloniality where health and disease processes, and thus medical assistance, were utterly industrialized and commercialized. The ensuing process of re-signification of the medical knowledge produced by health professionals at large was crucial within the libertarian, revolutionary strategy of questioning the social, political and cultural establishment. Indeed, the relationship between the unions and the medical professionals was never free of trouble, confrontation and controversy. As can be followed through the pages of the union newspaper *Solidaridad Obrera* (1907–1939, in its first run), intellectual workers were initially excluded from the anarchist union, the National Confederation of Labour (CNT), upon the First International principle that workers should undertake their own emancipation, without the interference of any other class interests. Nevertheless, the aid of intellectuals or professionals was eventually enlisted to defend union interests despite the underlying distrust and subsequent encouragement of self-instruction and mutual teaching that so much characterized the anarchist movement. Aware of the power of knowledge for social transformation, as well as of the importance of resulting interpretations of reality in accordance with class interests, anarcho-syndicalists fostered an extensive knowledge of subjects that concerned the proletariat or that potentially bore a strong social impact¹².

In this context, the relationship of intellectuals and professionals with the CNT in the three decades before the Spanish Civil War went through several and often contradictory phases: from the establishment of the Union of Intellectual Workers and Liberal Professions, which grouped *non-manual* members in a single union and separated them from their respective trade unions in order to avoid their direct control; through their incorporation into the CNT, as a short-term revolutionary solution, where it was necessary to boost the efficacy of the struggle against capital and to prepare and organize society in libertarian terms, owing to the quick expansion of the union (in terms of members and regions covered), the euphoria prompted by the Soviet revolution, and the increasing radicalism against employers' intransigence; to the final split-off of the union, precisely in relation to medical-health practices, as happened on account of the discrepancies regarding a proposal to establish a mutual aid society within the CNT to fight tuberculosis. In this sense, and as reflected in the pages of *Solidaridad Obrera*, it is possible to map the

¹² Jiménez-Lucena and Molero-Mesa, "Good birth and good living"; Molero-Mesa and Jiménez-Lucena, Isabel, "Simpatía por los manuales". Bohn, "Inclusion and exclusion".

confrontation between the moderate syndicalist sector, which was in favour of the mutual aid society, and the sector closer to the *Federación Anarquista Ibérica* (Iberian Anarchist Federation, FAI), which favoured direct action, meaning that, among other aspects, tuberculosis, just like other social diseases, could only be uprooted by subverting the established order, and that such a project was therefore far from proletarian as it found its breeding ground precisely in the conditions the union wanted to subvert. As a result, the split-off took place between 1931 and 1932, when the moderate syndicalist sector left the confederation and created the *Sindicatos de Oposición* (Opposition Unions), while the mutual aid society project eventually collapsed¹³.

This example shows the anarcho-syndicalist strategy against direct, technocratic interference by physicians, as professionals, in the union. However, the economic and health situation of the workers, coupled with the anarchist rejection of charitable assistance, brought about another point of collaboration between the physicians, who were developing their own inclusion strategies, and anarcho-syndicalists: free medical consultations. Without counting the medical enquiries that appeared as questions and answers in the anarchist press, physicians (either union members or sympathizers) offered cheaper or free consultations through discounts linked to coupons that appeared in certain magazines such as *Generación consciente* (1923–1928) or its continuation *Estudios* (1928–1937: see below), through low-priced visits at certain times of the day or, in the case of totally free visits, if the patient met certain conditions, like being unemployed and/or having been abused by the mutual aid societies or insurance companies. However, this kind of relationship was also not devoid of problems, such as suspicion of mercantilism, in part a result of the sustained reciprocal mistrust between physicians and workers. Nevertheless, anarcho-syndicalists saw an opportunity to achieve a balance between *manual* and *non-manual workers* through these collaborations with healthcare experts, which prompted the editors of *Solidaridad Obrera*, even after the change in management and the expulsion of the syndicalist sector, to praise such initiatives and wish for other intellectuals to follow the example¹⁴.

Roughly one decade later, after the Spanish Civil War and the advent of the fascist regime, Franco and his supporters had to establish and consolidate a radically

¹³ Molero-Mesa and Jiménez-Lucena, Isabel, “Simpatía por los manuales”.

¹⁴ Molero-Mesa and Jiménez-Lucena, Isabel, “Simpatía por los manuales”; Jiménez-Lucena and Molero-Mesa, “Good birth and good living”; Taberner, Jiménez-Lucena and Molero-Mesa “La redefinición de la participación”.

different socio-political situation. They were in need of social, economic and administrative structures which would allow the survival of the regime after three years of devastating war. They also had pressing political, ideological and cultural needs, at home and abroad. The increasing international isolation and the concurrent, early autarchic articulation of the regime was concurrent with a multidimensional, strong-arm strategy aimed at its building and legitimating in a context where the population had to cope with widespread poverty, starvation and epidemics, in isolation and with a conspicuous shortage of resources¹⁵. In such a context, the efficient indoctrination of the people was a must, and sprang from the justification of a repressive, unwavering, while apparently giving system, built around the paternalistic figure of the dictator. The regime applied a sweeping social and historical de-contextualization program in order to erase all signs of continuity from the Republican period. This was achieved, among other aspects, through the construction of a socio-political project, national-syndicalism, which structured knowledge management in strictly asymmetrical flows of information, *from one* (the One, Franco) *or a few* (the Fascist Party, the Spanish Military, the Catholic Church) *to the many* (the population at large), and where adherence to the rulers, in political, ideological and moral terms was in practice articulated as subjection and obedience to the experts¹⁶.

Accordingly, Franco's administration regarded medical-health and mass media practices and discourses as (two of the) primary means for the building of such a social, ideological and political scheme. In this regard, one particularly significant characteristic of medical-health practices, discourses and policies was the unavoidable

¹⁵ Paul Preston, *Franco. A Biography* (New York: Basic Books/Harper Collins, 1994); Jorge Molero-Mesa, "Health and public policy in Spain during the early Francoist regime (1936-1951): the tuberculosis problem". In: Ilana Löwy; John Krige (eds). *Images of Disease: Science, Public Policy and Health in Post-war Europe* (Luxembourg: Office for Official Publications of the European Communities, 2001), pp. 141-161; María Isabel Del Cura; Rafael Huertas, *Alimentación y Enfermedad en Tiempos de Hambre. España, 1937-1947*, (Madrid: CSIC, 2007).

¹⁶ Sheelag M. Ellwood, S. M. (1987) "Spanish newsreels 1943-1973: The image of the Franco regime". *Historical Journal of Film, Radio and Television* 7: 225-238; Jiménez-Lucena, Isabel (1994) "El tifus exantemático en la posguerra española (1939-1943): El uso de una enfermedad colectiva en la legitimación del 'Nuevo Estado'". *Dynamis* 14: 185-198; Rafael Rodríguez-Tranche; Vicente Sánchez-Biosca, *NO-DO, el tiempo y la memoria* (Madrid: Cátedra/FilMOTECA Española, 2001); Pablo I. Taibo, *Un cine para un imperio. Películas en la España de Franco* (Madrid: Oberon, 2002); Jiménez-Lucena, Isabel; Ruiz-Somavilla, María José; Castellanos-Guerrero, Jesús (2002) "Un discurso sanitario para un proyecto político. La educación sanitaria en los medios de comunicación de masas durante el primer franquismo". *Asclepio* LIV(1): 201-218; José Enrique Monterde, "El cine de la autarquía (1939-1950)". In: Roman Gubern *et al.* (eds). *Historia del cine español* (Madrid: Cátedra, 2004), pp. 181-238; Medina-Doménech, Rosa M.; Menéndez-Navarro, Alfredo (2005) "Cinematic representations of medical technologies in the Spanish official newsreel, 1943-1970". *Public Understanding of Science* 14: 393-408; Felipe E. Ramírez-Martínez, "Ciencia, tecnología y propaganda: el NO-DO, un instrumento de popularización de la ciencia al servicio del Estado (1943-1957)". In: Javier Ordóñez (ed). *El pensamiento científico en la sociedad actual* (Madrid: MEC, 2006), pp. 253-261; Tabernero, "Cine y procesos de medicalización"; Tabernero, Jiménez-Lucena and Molero-Mesa, "Film, medicine and empire".

direct contact between experts (physicians, institutions) and non-experts (patients), as it necessarily occurs through everyday practice with the purported expert aim of offering immediate solutions (health) to the pressing everyday-life problems (illnesses) of non-expert people. On the other hand, mass media also provided a corresponding kind of contact, as they are technological means through which experts (producers, editors, distributors and institutions as well) offer non-experts (readers, listeners, viewers) multifaceted immediate solutions (information, education, entertainment) to modern life needs¹⁷. From this perspective, medicine-health and mass media bear a manifest strategic importance from a joint social, economic, political and cultural point of view. The aims, methods and scope of (institutionalized) transmission of expert medical-health knowledge to non-experts are, and were in that context, crucial for the shaping of (social and institutional) power relations. In this sense, the mechanisms of techno-scientific knowledge production, circulation and management are central to the broad-spectrum socio-cultural dynamics of granting and sharing authority, responsibility and values. As a result, and insofar as indoctrination was decisive for the building of the regime, Franco's administration applied an unconcealed vertical and unidirectional model of knowledge management, as described above, in an overtly (and, as we know, tragically) opposed manner to the anarchists' more problematical, questioning strategy that we have advanced. The fascist regime model responded to a will of indoctrination and, with a wider scope, enculturation, precisely on the part of those few experts that lie on one end of the attempted linear process. They aimed at social cohesion, which was ultimately and when possible warranted by the allegedly utilitarian, incommensurable, neutral and inaccessible (for the recipient non-experts) character of both a specific kind of knowledge (in our case, and significantly, scientific-technological, medical-health) and the devices (in our case, media technology) primarily used for its circulation. Hence, under the forcible provisions of the totalitarian regime, yet following a widespread model in western industrial societies, medical-health and media experts would be *the* necessary sources of the abovementioned urgent solutions for the many non-experts' everyday problems and needs¹⁸.

¹⁷ Tabernero, "Cine y procesos de medicalización"; Tabernero, Jiménez-Lucena and Molero-Mesa, "Film, medicine and empire"; Tabernero, "El proceso salud-enfermedad".

¹⁸ Ellwood, "Spanish newsreels"; Jiménez-Lucena, Ruiz-Somavilla and Castellanos-Guerrero, "Un discurso sanitario para un proyecto político"; Medina-Doménech and Menéndez-Navarro, "Cinematic representations of medical technologies"; Ramírez-Martínez, "Ciencia, tecnología y propaganda"; Tabernero, "Cine y procesos de medicalización"; Tabernero, Jiménez-Lucena and Molero-Mesa, "Film, medicine and empire".

In this context, cinema was deemed by the regime to be an essential means of enculturation. The regime took into account the capacity of this medium to generate diegetic, performative prototypes pertaining to social, political, ideological, and cultural structures¹⁹. Building on these premises, the analysis of five medical-colonial documentaries produced by Hermic Films in 1940s Spain show the characteristics of the regime's combined use of medical-health and media practices and discourses for its building, justification and legitimation purposes. Three of these documentaries, *Médicos coloniales* (*Colonial physicians*), *Los enfermos de Mikomeseng* (*The sick people from Mikomeseng*) and *Fiebre amarilla* (*Yellow fever*), were directed by Manuel Hernández Sanjuán, co-founder of the production company, in Equatorial Guinea in 1946. These films were part of a governmental request made directly to Hernández Sanjuán by the General Director of Morocco and Colonies, General José Díaz de Villegas Bustamante; the other two, *Enfermos en Ben-Karrich* (*Sick people at Ben-Karrich*) and *Médicos en Marruecos* (*Physicians in Morocco*), were shot in Morocco in 1949 and directed by Santos Núñez, who had been the scriptwriter for Hernández Sanjuán in Guinea. All of them were a product of the strong linkage of Hermic Films with colonial cinematographic projects²⁰.

Medical-health practices and discourses were represented in these documentaries not only as a compulsory and unbiased (as scientific-technological) source of certainty, cohesion and power, but as imperative and heroic. It is indeed highly significant that medical-health issues as well as science and technology (resources, ethnology and wildlife) were chief themes in this media project along with other three key organizational foundations for the regime, that is, religion, education and the military. Interestingly, apart from medical-health and film practices and discourses, the films incorporated a third set of practices and discourses, the colonial–imperial, which was equally strategic for the regime.

The colonial context provided the opportunity for an explicit portrayal of the building and management of a specific kind of society through expert-driven and, as

¹⁹ Kirby, David (2010) “The future is now: Diegetic prototypes and the role of popular films in generating real-world technological development”. *Social Studies of Science*, 40(1): 41-70; Jiménez-Lucena, Isabel (2011) “Differences, paradoxes and exclusions regarding abortion. A possible interpretation of A Story of Women and Vera Drake”. *Journal of Medicine and Movies*, 7(2): 61-68; Tabernero, Carlos (2006) “L’Audiència-meca: ciència, tecnologia i la condició humana en el cinema de Stanley Kubrick i Steven Spielberg”. *Mètode* 48: 71-76; Ellwood, “Spanish newsreels”; Rodríguez Tranche and Sánchez Biosca, *NO-DO, el tiempo y la memoria*; Monterde, “El cine de la autarquía”; Medina-Doménech and Menéndez-Navarro, “Cinematic representations of medical technologies”; Tabernero, “Cine y procesos de medicalización”; Tabernero, Jiménez-Lucena and Molero-Mesa, “Film, medicine and empire”;

²⁰ Tabernero, “Cine y procesos de medicalización”; Tabernero, Jiménez-Lucena and Molero-Mesa, “Film, medicine and empire”.

such, purportedly impartial processes of definition, classification, rationalization and disciplining of human clusters. In addition, the combination with the scientific-technological character of documentary filmmaking, that is, of the form simultaneously with the content, turned them into an unconcealed legitimating (indoctrinating, yet again as seemingly objective) device. The articulation of (medical-health and colonial) discourses, together with the representations of spaces, instruments and the (expert and non-expert) people who inhabit and use them, give us an account of the interrelated position of all the actors, practices and discourses involved, i.e., power relations as related to medicalization processes. This includes not only the people (colonizers and colonized) featured in the documentaries, but also the intended audiences (mostly in the mother country) and the filmmakers themselves, thus conveying their impact in the social, political and cultural construction of the regime's identity²¹.

Accordingly, the depiction of the social dynamics featured a clear-cut differentiation between medical-health experts and non-experts, which responded unambiguously to a social stratification program where the distinct positions of different human clusters (across race, class and gender) with respect to knowledge production and management practices and discourses were unmistakably defined. Consistent with the unidirectional model, as mentioned above, the few experts, always officials and physicians, and all of them Spanish white men, scrupulously and competently provided the solutions to the everyday sufferings afflicting the many non-experts, certainly patients, that is, the population at large in danger. These were always openly portrayed as captive and submissive to the experts' allegedly objective directives and, by extension, moral and ideological principles (as suggested by the ever-present religious aid and tutelage, mostly by nuns). And they were, as expected, the natives, men, women and children from working-class and peasant families, but also Spanish women and children (particularly in the Moroccan context). The exception to this scheme was the portrayal of male and female natives and white women working as medical-health technicians, i.e., closer to the white male expert

²¹ Tabernero, "Cine y procesos de medicalización"; Tabernero, Jiménez-Lucena and Molero-Mesa, "Film, medicine and empire". Technically speaking, the voice-over narration, identifiable with the dictator, and which was a staple in the regime's compulsory and exclusive official newsreel (*NO-DO*), conveniently put forward a de-contextualized glorification of the new state and its dictator. In addition, the commentary aptly combined technical expressions with colloquial phrases and anecdotes, conveying a reliable definition of an expert authority, practical and unbiased, while steadfast and familiarly paternalistic. And all this articulated within a backdrop of medical technologies and facilities posing as the regime's tools for modernization, efficacy, competence and dependability. See also: Medina-Doménech and Menéndez-Navarro, "Cinematic representations of medical technologies".

sphere, although as subaltern staff and thus always under the necessary supervision of the specialists. Such crossing of the (scientific-medical) knowledge production and management boundary is a constitutive and unambiguous ‘excluding–inclusion’ strategy in the processes of creation and maintenance of techno-scientifically driven social stratifications²². It indeed helps presenting a non-problematic, idealized colonial space, whether in strictly colonial (or post-colonial) settings, or in the bourgeois, capitalist modernity–coloniality so openly contested, as described by the Spanish anarchists in the previous decade.

3. Education and power

Indeed, all these inclusion-exclusion, (de)medicalization processes, as portrayed in the pages of an anarchist union newspaper or in a series of fascist-sponsored films, cannot be fully understood without the associated practices and discourses aiming at the re-signification, one way or the other, of knowledge. One key feature of this research is that we are probing the communication practices involved in the production, distribution, appropriation and consumption of the press and the cinema. Therefore, to the depictions of the complex relationship between experts and non-experts, we must add a communication-based theoretical framework in order to contribute a comprehensive understanding of all the elements involved in these dynamics, in this case, concerning medical-health practices and discourses.

We start from the understanding of science as “a form of communicative action”, as well as “a practical activity, located in the routines of everyday life”²³. This standpoint helps to establish meaningful analytical linkages between science and the media. First, we must take into account the deep embedding of these two sets of practices and discourses in everyday socio-cultural power relations. The appraisal, adoption, use and modification of techno-scientific (medical-health, for our purposes here) and media practices and discourses by all actors, from the generation to the consumption and/or application of knowledge according to individual or collective needs, beliefs, concerns, expectations and attitudes are essential, albeit extremely complex elements in the social and cultural assumptions, workings and tensions that routinely take place in people’s everyday lives. Also, from the premise that cultural

²² Kusiak, “Instrumentalized rationality”; Medina-Doménech, “Scientific technologies of national identity”; Tabernero, “Cine y procesos de medicalización”; Tabernero, Jiménez-Lucena and Molero-Mesa, “Film, medicine and empire”; Jiménez-Lucena and Molero-Mesa, “Good birth and good living”.

²³ Secord, “Knowledge in Transit”, p. 655, p. 661. Topham, Jonathan R. (2009). “Focus: Historicizing ‘Popular Science’. Introduction”. *Isis* 100(2): 310-318.

appropriation and consumption are in fact cultural productions and the above consideration of science as a set of communication practices, it appears reasonable to add practice theory as applied to media in order to attempt an account of the interrelated position of all the key actors (i.e., experts and non-experts, as described above) and circumstances (such as the abovementioned everyday life routines and interactions and the associated embodiments of knowledge, including symbols, objects and spaces) involved with respect to the social, political and cultural implications of the processes of science popularization. An apparently straightforward question about what people do in relation to media in all possible situations and contexts leads directly to the exploration of routine contexts, whether of production, circulation, and/or significantly, appropriation, as particular sites of empirical interest. Furthermore, this combined theoretical framework (science as communication, media as practice) fosters the critical consideration of everyday life scientific-medical and media discourses and practices from the point of view of their deep involvement processes of power, as in inclusion-exclusion dynamics as constituent elements of the habitual processes of action and interaction between people, groups and institutions, and where the nature of authority is regularly and consequentially probed, especially in an increasingly mass-mediated culture²⁴.

Drawing on all these theoretical elements, we can tackle the problem of education from a quite different point of view, if we take into consideration the multidimensional intersections between techno-scientific knowledge management and mass media. On the one hand, educational venues and institutions, as spaces where knowledge is circulated on a large scale, may be considered as 'mass media'. Conversely, the use and consumption of mass media, which are significantly influential on social, communication and working skills, as well as essential constituents of the social and space-time structure of people's everyday lives, may very well be understood as informal (albeit major) learning spaces, where meaningful processes of generation, circulation and management of knowledge, scientific-medical in our case, occur. Importantly, all actors involved, that is, mass media users (all the way from production to consumption, and in the same way as teachers, students,

²⁴ Michel de Certeau, *The Practice of Everyday Life* (Berkeley: University of California Press, 1984); Couldry, "Everyday Life in Cultural Theory", "Theorising Media as Practice"; Topham, "Historicizing 'Popular Science'"; Bräuchler and Postill, *Theorising Media and Practice*; Taberero, "Cine y procesos de medicalización"; Taberero, Jiménez-Lucena and Molero-Mesa, "Film, medicine and empire"; Carlos Taberero, Jordi Sánchez-Navarro, Daniel Aranda and Imma Tubella, "Media practices, connected lives". In: Cardoso, G., Cheong, A., Cole, J. (eds.) *World Wide Internet: Changing Societies, Economies and Cultures* (Macau: University of Macau, 2009), pp. 331-355.

textbook authors and editors, families, etc., in official educational institutions), contribute in one way or another to processes of validation and/or questioning of a particular kind of knowledge and the associated authority systems. Media cannot just be deemed as technical means of manipulation through entertainment, as their appropriation is a dynamic and ultimately productive process of (self-)reflection taking place within the everyday social and cultural structure, where a wide range of assimilations, as well as negotiations and resistances take place²⁵.

The independent (not associated with the CNT) and prestigious (in libertarian circles) magazine *Estudios* sported a predominantly and overt pedagogical approach since education and culture were deemed an indispensable revolutionary basis. In this spirit, it dealt with a wide-ranging choice of subjects, which in turn were treated by a corresponding wide range of contributors, regardless of their ideological leanings, thus fostering debate. Within this framework, science and medicine were particularly important subjects and sources for argumentation, where medical-health issues were discussed primarily from the perspective of the questioning and re-signification (as we have advanced above) of official discourses and practices and toward the construction of an alternative biopolitics, which did not reject the input of medical professionals. However, the alternative approach was based upon the combined application of (a) neo-Malthusianism, in terms of claiming people's right to self-management of sexuality in relation to population control; (b) eugenics, in environmental terms, where living conditions were paramount (over strictly etiological explanations) to define health and disease in relation to workers' everyday lives; and (c) naturism, in terms of naturist medicine as a basis precisely for the overall re-signification not only of health and disease, but also of the processes involved in their management. The fundamental departure of such an approach from mainstream medical-health management was the spirited encouragement of individual and/or collective self-management of health and disease, as opposed to the submission to public or private institutional interests. As a result, such a pattern of re-signification of science and medicine and of health and disease became an essential

²⁵ Thompson, *The Media and Modernity*; Tabernero *et al.*, "Media practices"; Couldry, "Theorising Media as Practice"; de Certeau, *The Practice of Everyday Life*; Tabernero, "Cine y procesos de medicalización"; Tabernero, Jiménez-Lucena and Molero-Mesa, "Film, medicine and empire". Tabernero *et al.*, "Media practices, connected lives".

constituent for the anarchists' questioning strategies of the social, political and cultural establishment²⁶.

Moreover, such a strong call for people's self-management found its most unequivocal expression in *Estudios*'s medical-health Q&A section (*Preguntas y respuestas*, 1930–1937). Established as a response to the large amount of letters sent by readers concerning primarily medical-health issues (which was one of the main editorial interests of the publication), but also, following the magazine's eclectic publishing approach described above, about many different topics, it was run by a physician, Dr. Roberto Remartínez, a regular contributor to *Estudios*. While abiding by a long-standing tradition of press-mediated direct exchange between readers/consumers and writers/editors²⁷, and notwithstanding the primary focus on medical-health issues (as directed by incoming letters), Remartínez gradually and purposefully made it a place for the account and discussion of a broad spectrum of subjects, always with the readers' active involvement²⁸.

The exchange between readers and Remartínez constitutes a case in point of the combined, multidimensional input of experts and non-experts in processes of generation and management of scientific and medical knowledge. Remarkably, it takes place through the multi-layered communication practices associated with the publication and circulation of a magazine, *Estudios*. The eclectic spirit of the magazine was openly tried out through the interaction between Remartínez and his readers. Most questions focused on personal medical-health issues, and covered a wide variety of problems and concerns. However, Remartínez's insistence on the educational aim of the section and the need to address general cultural topics, as well as, significantly, the readers' undeniable will to participate in the construction of knowledge, resulted in a wide-ranging discussion of subjects beyond private health. In this sense, medical-health issues were thus increasingly addressed from the point of view of the connection between people's actual everyday concerns and their wider social,

²⁶ Jiménez-Lucena and Molero-Mesa, "Good birth and good living"; Tabernero, Jiménez-Lucena and Molero-Mesa "La redefinición de la participación"; Tabernero, "La sección 'Preguntas y Respuestas'"; Molero-Mesa and Jiménez Lucena, "Otra manera de ver las cosas". Martí i Boscà, José Vicente (2006), "Estudios: educación sexual, arte, ciencia, cultura general". In: *Estudios. Revista Ecléctica*. Fxíimil Edicions Digitals <<http://www.numerossueltos.com/news/cat/faxdocs/post/faxdoc23/>>; Richard Cleminson (2003), "'Science and sympathy' or 'sexual subversion on a human basis'? Anarchists in Spain and the World League for Sexual Reform". *Journal of the History of Sexuality* 12 (1), 110-121; Francisco J. Navarro, 'El paraíso de la razón' *La revista Estudios (1928-1937) y el mundo cultural anarquista* (Valencia: Edicions Alfons el Magnànim, 1997).

²⁷ Robin Kent, *Aunt Agony Advises. Problem Pages through the Ages* (London: W. H. Allen, 1979); Angela Phillis, "Advice columnists". In: Bob Franklin (ed.) *Pulling Newspapers Apart. Analysing Print Journalism* (New York: Routledge, 2008), pp. 97-105.

²⁸ Tabernero, Jiménez-Lucena and Molero-Mesa "La redefinición de la participación"; Jiménez-Lucena and Molero-Mesa, "Good birth and good living".

ideological and cultural predicaments. And so, the open space for other topics was progressively filled, and questions addressed issues such as naturism, education, history, theosophy, techniques and recipes for the manufacture of drugs, and even the theory of evolution and theoretical physics²⁹.

In this context, the readers acknowledged, for the most part, the all-out authority of the expert, surely as a private physician, although Remartínez constantly directed readers to the confidential questionnaires that addressed the strict and regular medical consultations; but also as an across-the-board intellectual, given the range of subjects treated. In this sense, the Q&A section played out some of the conflicts described with respect to the complex inclusion and exclusion dynamics regarding intellectuals and professionals, and particularly physicians, in the union, including the suspicion of Remartínez's ultimate mercantilist goal. Nonetheless, and despite Remartínez (and the editorial board) having ultimate decision on what was to be published, a significant amount of questions showed an uncompromising will on the part of the readers to introduce and/or insist on the discussion of certain issues that were fundamental for the anarchist questioning of the bourgeois system. This was particularly important considering the magazine's high print run and its prestige within libertarian circles. All the same, the Q&A exchanges also revealed multidimensional (de)medicalization dynamics, by considering that different degrees of assimilation, but also of questioning and re-signification of socially accepted and officially sanctioned discourses and practices, took place, interestingly involving both the readers' questions and Dr. Remartínez himself³⁰.

The medical-colonial documentaries made by Manuel Hernández Sanjuán and Santos Núñez in the already fascist Spain lie, as expected, at the opposite end of the anarchists' approach to knowledge management. They did indeed comply efficiently with their enculturation function. Information (the documenting of a distant reality for the intended mother-country audiences), education (the portrayal of the organizational traits of a comprehensive civilizing effort in an apparently non-problematic setting), and entertainment (featuring an exotic and heroic context) were efficiently combined to highlight the allegedly necessary, across-the-board social, political and cultural endeavours of the regime. The weight of medical-health practices and discourses as building and managing tools for the regime was

²⁹ Tabernero, Jiménez-Lucena and Molero-Mesa "La redefinición de la participación"; Jiménez-Lucena and Molero-Mesa, "Good birth and good living".

³⁰ Tabernero, Jiménez-Lucena and Molero-Mesa "La redefinición de la participación".

underlined through the intertwining of the scientific-technological character of both the colonial medical-health activities depicted and the documentary filmmaking, that is, of the form *and* the content. A number of cinematic techniques contributed to the intended indoctrination that this represented: first, the distinctively didactic format through the use, as introduction or for contextualization, of animated graphics and maps, microphotography techniques, and *historical* accounts of the medical-health issues shown, always conveniently devised according to the regime's essentialist aims and asymmetrical information model; and second, the suitable combination of these didactic elements with the entertainment provided by the heroic adventure that was depicted, where medical-health science and technology were portrayed as an all-out spectacle and as a set of commodities ready for everyday consumption. Such didactic spectacle and achievement were made possible precisely through the self-denying, rigorous and outstanding efforts (as explicitly qualified) of experts and officials, whose guiding function thus becomes unquestionable³¹.

Bearing this in mind, a two-sided identification effect was projected on Spanish audiences, which were the fundamental target of the regime's legitimating and consolidating needs and efforts: on the one hand, with the white European colonizers, that is, the ruling, civilized Spaniards, or, in other words, significantly with the vertical exercise of power and its utter justification; yet, on the other, with the colonized, for, despite racial and socio-cultural differences, they were also patients, workers, peasants, and women, all desperately needing solutions and information, particularly pertaining to medical-health issues, but also with regard to their situation according to the new regime's intentions and capabilities. In this sense, the filmmakers also played two complementary roles, as colonizers, for, upon arrival, they joined the ruling communities in the colonial settings, but also as colonized, as direct witnesses, while *ad hoc* beneficiaries, and the very first public, largely in awe of the regime's colonial endeavours, for which they offered, in their films, a primary and glorifying interpretation. As a result, the documentaries (that is, cinema) became an essential part of the solution, as a source of evasion, so much needed in post-war Spain (film-going was arguably the most important form of entertainment in that context), but efficiently combined with the information and education goals that completed an overtly vertical model of knowledge management. The movie theatre thus worked as an entertainment-driven science space, devoted, in this case, to

³¹ Tabernero, "Cine y procesos de medicalización"; Tabernero, Jiménez-Lucena and Molero-Mesa, "Film, medicine and empire".

medical-health instruction in connection with crucial social, political, moral and ideological aspects, which the regime pass onto the population through ordinary, everyday communication practices³².

4. Visibility and participation

The two case studies presented in this paper illustrate the complex dynamics of knowledge management (generation, circulation, appropriation) as articulated through the relationship between two fundamental sets of practices and discourses for the processes of construction and functioning of contemporary societies: medicine-health and mass media. Beyond their particular historical significance, they become, when jointly mulled over, remarkably revealing, owing to their radical opposition in terms of the approaches to knowledge management they represent and also because of the historical continuity provided by the common geo-cultural context (Spain, mostly in the 1930s and 1940s, but arguably projecting throughout at least two thirds of the 20th century) and, therefore, the main characters that is, the Spanish population, experts, non-experts and all categories in between.

Both cases embody the multi-layered, multidimensional character of scientific knowledge management dynamics while confirming the weight of mass media in such processes. They share several important features: medical-health practices and discourses and their social, political and cultural implications in people's everyday lives (individually and collectively) constituted the primary focus; conferring meaning (signification, re-signification) to those practices and discourses, in completely opposite ways; the input from medical-health professionals as necessary technical advisors in these processes was always required; inclusion and exclusion strategies from a combined socio-political and professional perspective, concerning different human groups (including the relationship between professionals and intellectuals with the population at large, as well as comprehensive race, class and gender relations), and across the boundaries of knowledge production and management were significantly at stake; and the key role of medical-health and mass media practices and discourses in the building of a given social, political and cultural organization (whether libertarian or fascist) was explicitly acknowledged, both through content (medical health) and precisely by the very means used (the press, cinema).

³² Tabernero, "Cine y procesos de medicalización"; Tabernero, Jiménez-Lucena and Molero-Mesa, "Film, medicine and empire".

All these features revolved around a noticeable effort to make the (individual and/or collective) experience of disease visible. And such an effort shows the complexity of knowledge construction and management processes in terms of the different patterns of participation used in each case. On the one hand, the Q&A section of *Estudios*, by fostering an ever-increasing level of visibility of individual experiences of illness, achieved with the active collaboration and for the ultimate benefit of its readers and the community, unreservedly looked for alternative, bottom-up ways to expose and define diseases in a counter-hegemonic spirit. Conversely, the colonial-medical documentaries produced in the first decade of Franco's regime, by making diseases visible through an overt de-contextualizing strategy (by use of the colonial settings), used an extremely top-down perspective, where individual experiences of illness were obliterated, for the sake of justification and legitimizing of the new socio-political status quo. In both cases, the definition of sicknesses was pursued, with all the metaphorical charge, even though in quite opposite terms, that is, as applied to capitalism by the former or to anarchism and communism by the latter.

Moreover, and notwithstanding individual and collective sets of interests, in the first case, physicians (Dr Remartínez as administrator of the Q&A section and the many other physicians that contributed regularly to *Estudios* and other anarchist publications) worked together with readers in these processes through a lively exchange that involved not only the abovementioned contributions, but also direct contact through the magazine- and the union-sponsored actual medical consultations, made available for workers and their families, and in particularly favourable conditions for those having difficulty to make ends meet. The aim was to improve the overall (physical, social, cultural, moral) living conditions of the population. In the second case, however, physicians joined the ranks of the necessary technicians who had to collaborate with the regime's structural keystones (dictator, fascist party, military, Catholic Church) in order to control the population (physically, yet, by extension, also at the social, moral, ideological and cultural levels), with the aim of building and consolidating that regime.

And finally, and importantly, all these processes were developed through media-related communication practices, from the mechanisms of production of knowledge, to its appropriation and consumption, whether by acquiring, reading, sharing and contributing to a publication, or by going to the movies, in both cases being ways to cope, or to help cope with far-from-easy predicaments. The different

aims, scopes and strategies surely yielded different results, although in both cases the construction of scientific-medical knowledge transcended the limits of the traditional, institutional, public or private, spaces of knowledge production, with their discourses and practices.

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Science popularization, hegemonic ideology and commercialized science

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Abstract

This paper attempts to discuss the relations between science popularization and hegemonic ideology. The latter is continuously in need to rearticulate itself, and science popularization appears to be one of the means for such a rearticulation. Nevertheless, it also appears that hegemonic ideology and scientific popularization are strongly linked with the construction of utopias, such as those of a world of almost free energy of the 1950s and of a world free of diseases of post-1980s.

Keywords: ideology, popularization, utopia, reductionism, European science.

There has already been extensive and interesting work concerning the popularization of science and, by now, the diffusionist model of popularization as a process of transferring knowledge from a source by those who 'know' to an audience comprised of those who 'do not know' is shown to have reached its explanatory limits. In 1994, almost 20 years ago, a seminal paper by two historians of science, Roger Cooter and Stephen Pumfrey¹ redefined the topography of the issues related to science popularization. Their work and the interventions made later on by Jim Secord², forced us to shift the emphasis from a diffusionist model to the view that historians should study the circulation of knowledge and the multifarious ways that such circulation brings about a sense and consciousness of what is science, what is scientific and what is scientificity. Thus, popularization has been freed from being considered a well-defined, specific and restricted form of scientific genre and its characteristics are now considered as being perpetually present in almost every form of scientific activity.

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¹ Roger Cooter, Stephen Pumfrey, "Separate Spheres and Public Places: Reflections on the History of Science Popularisation and Science in Popular Culture", *History of Science*, 1994, 32: 237-67.

² Jim Secord, "Knowledge in Transit", *Isis* 2004, 95: 654-672.

Through such works, popularization perceived as a process by which difficult things are made easy, appears to be abandoned. Nevertheless, an amazingly large number of people involved in newspapers, book writing and the media do exactly this, that is, they attempt to make complicated things easy. But instead of concentrating on the cognitive aspects of what is being transmitted or on the particularities of the language through which complicated scientific knowledge is transmitted, many historians of science have been looking at the question about the ways by which society at large or a number of social groups get in touch with science. And when we refer to science, we do not mean only the content of science, but the overall culture of science, the overall mentality of what it means to be scientific.

Here, then, is an interesting challenge for historians of science. It would be intriguing to investigate the ways the culture of science is being communicated and how this culture is being appropriated by various social groups. It does not matter whether we talk of expository science, knowledge in transit, circulation of knowledge or science popularization, it does not even matter whether we talk about the culture of science, scientific culture, science *in* culture, or science *as* culture, as long as we remember that when we discuss issues in the popularization of science we are referring to a set of social relations linking different communities with allies, audiences, publics and consumers. And it is, also, important to emphasize that such an approach to the popularization of science, is something where members of the relatively newly emerging communities of historians of science, like the historians of science and technology in Brazil, Portugal, Spain, and Greece, can bring in amazingly interesting elaborations on these themes, since the issues related to local conditions and the problems associated with the particularities of the localities play such a dominant role in examining the issues around science popularization.

Is this all? Does the admittedly complicated function of science popularization exhaust itself in our trying to understand the social relations linking different scientific communities with their allies or the construction of their audiences and publics? Though this is not such a mean job at all, what I would like to do in this paper is to raise a number of questions the nucleus of which centers on a rather neglected aspect of popularization. I am referring to ideology. How can one study the “presence” of ideology in popular scientific knowledge? How is the ideology of those who circulate knowledge imprinted upon the knowledge they circulate? How does ideology affect the means of circulation, the materiality through which such a circulation is being achieved? How does this materiality interact with ideology? Are

there any indications that the communication of the culture of science and its appropriation becomes part of the process of communicating and strengthening the hegemonic ideology? And, if yes, how do the various forms of knowledge in circulation fuse into (re)defining the dominant or hegemonic ideology?

I shall not discuss what ideology is since the point is not to sanitize the notion of ideology through an analytical discussion; on the contrary, it may be more useful to adopt an operational notion of the dominant ideology as the sum total of a particular worldview and value system shared by most in a society. Of course, when one is talking about ideology one does not look for something that is homogeneous and shared by all in a society in all its details. What is, however, characteristic of the dominant ideology is the fact that despite the various differentiations found among groups of people, there is a hard core of values, perceptions, beliefs, explanations and mores that are shared by many.

Often we talk of a hegemonic ideology. The concept of hegemony was basically developed by Antonio Gramsci (1891-1937). In his view, in a particular historical context, social stability cannot be properly understood by considering that the exclusive reason for such stability is the social control through the various state institutions. This political stability has to be explained by other factors, of further coercion. Therefore, hegemony brought to the fore how the so-called *civil society*, with its institutions ranging from education, religion and family to the microstructures of practices of everyday life, contributes to the production of meaning and values, which direct and maintain the 'spontaneous' consent of the various strata of society.³ Thus "hegemony is not simply the crude defence of the dominant opinions, nor the simple manipulation of things from above. It is much more than this: it embraces the whole of our reality, all our habits and hopes; it is our own perception of reality".⁴ It appears that cultural hegemony, and its acceptance and consent by a wide range of the social groups, is what contributes greatly to social stability. But such hegemony cannot be sustained unless it is continuously being formulated and reformulated through its negotiations with antagonistic ideologies. Surely hegemonic ideologies are social constructs, they are manifestations of specific social groups which aim at maintaining their dominant position in a society. Hegemony is achieved through a continuous contestation of ideas and norms. Those who vie for hegemony are obliged to be

³ Agustí Nieto-Galan "Antonio Gramsci revisited: Historians of science, intellectuals, and the struggle for hegemony," *History of Science* 2011, 49: 453-478.

⁴ Renate Holub, *Antonio Gramsci. Beyond Marxism and Postmodernism* (Routledge: London, 1992), quote on p. 6.

continuously asserting and reasserting their ideology, and to continuously devise new ways to argue convincingly about the authority of their particular ideology. Interestingly, science popularization in its most general sense appears to be one of the fundamental means through which the dominant ideology is being (re)produced and assimilated.

Such a relationship between science popularization and the hegemonic ideology should also be assessed within the framework that takes into consideration the dramatic changes, which are being witnessed during the last 25 years, concerning the very character of scientific practice. The enterprise to convince people that the so-called knowledge economies are something new and novel and, in a way to project such a state of affairs as the result of neoliberal economic policies, depended to a large extent on science popularization.⁵ Though knowledge economies are not something all that new, since from the beginning of the 19th century we have at least some kind of such economies, the establishment of the term as one of the neologisms in the days of globalization has been greatly eased through the popularization of all kinds of new innovations and new products. In addition, they were presented as the by-products of technoscience and the continuously strengthening ties between universities and industry. Symbolically, it was a decision by the US Supreme Court in 1980, which heralded the new period, the period many historians and sociologists of science termed as the period of ‘commercialized’ science: in the case of *Diamond v. Chakrabarty*, the Supreme Court ruled with a 5–4 vote that artificially created organisms could be patented under the US Patent Act; it was a decision that defined the framework for the patenting of genetically modified living creatures and the genetic material itself. In the same year the Bayh-Dole Act was passed by the US Senate and gave the right to universities as well as non-profit organizations to patent the results of publicly funded research. The latter act also contained certain confidentiality provisions for the protection of intellectual property prior to and during the patenting process. Nothing was the same after this watershed year and science—and more so its various forms of institutional expression—was to go through some lasting and rather dramatic metamorphoses.

Commercialization is not something new to science and the immediate or long-term uses of science were not a secondary consideration in the minds of many of

⁵ In this paper when there is reference to science popularization, science refers to the physical as well as to the other social sciences, economics being such a science whose ways of popularizing, in our days, far exceeds those of the physical sciences.

those who were involved in scientific practices over the centuries. But what has been happening in the last three decades brings to the surface trends of a rather unique character. Experiments like those at CERN (but not only there) appear to have been undermining the centuries' long faith in the repetition and duplication of experiments as a characteristic almost synonymous with the very existence of post-17th century science. An increasing number of scientists cannot get raw data from authors who have published articles in standard journals and who are bound by the contracts their institutions have signed not to disclose more details than those they publish. Large pharmaceutical companies, after assessing through their own experts the projects they fund in various laboratories of prestigious universities, often decide to ask those who are responsible for the projects to stop them and start other experiments. One of the rather serious side-effects of such a practice is that there are cases of postdoctoral appointments in highly prestigious laboratories where young scientists cannot get a single publication even after a tenure of a couple of years. Mathematical (and computer) modeling is progressively becoming the most widely sought path to 'reaching truth' in almost all disciplines. Of particular interest are the attempts in economics where new products are being constructed and are legitimized through complex social and ideological processes. It, thus, appears that the relation to the sciences of the ways such products are being constructed and which subsequently acquire value is also something new and widens the spectrum of scientific practices.

The new situation forces us not only to reconsider issues related with 'intellectual property rights' but more importantly to reconceptualize the Mertonian norms of science and ask whether universalism, communalism, disinterestedness and organized skepticism are still pertinent to describing the characteristics of science. And, in fact, many philosophers, historians and sociologists of science have been persistently asking the question of whether these norms have come to their historical end together with the kind of science they describe.⁶

The hypothesis I would like to explore is whether scientific popularization and the various forms of knowledge in circulation are involved in the processes of continuous rearticulations of the dominant or hegemonic ideology. Let me give an

⁶ G. Irzik, "Commercialization of Science in a Neoliberal World" in Ayse Bugra, Kaan Agartan, eds., *Reading Karl Polanyi for the Twenty-First Century: Market Economy as a Political Project* (Palgrave, London 2007); H. Radder "Mertonian values, scientific norms and the commodification of academic research" in H. Radder, ed., *The commodification of academic research: analyses, assessments, alternatives* (University of Pittsburgh Press, Pittsburgh 2010); C. McSherry, *Who owns academic work?* (Harvard University Press, Cambridge 2001); D.B. Resnik, *The price of truth: How Money Affects the Norms of Science* (Oxford University Press, 2007); S. Shapin, *The Scientific Life: a moral history of a late modern vocation* (Chicago University Press, 2008).

example of what I mean in the case of science popularization. One of the commonest aims of science popularization is to consider it as a process for narrowing the cultural gap between the 'elite' and other social groups. By transferring knowledge across cultural and class lines, the expressed rationale of most of science popularization is to bridge gaps, to achieve egalitarianism, to convey in simple words the power of science and the many possibilities it can offer for the edification and the benefit of the masses. But this very process does not *only* transfer 'objective' and 'useful' knowledge. The very belief that one can bring egalitarianism through popularization is, in itself, an ideological undertaking. Such an undertaking is also an attempt to imbue and instill audiences with a particular ideology, very often an ideology of neutral science, which can provide answers to all kinds of problems or, worse still that the character of the solution to many problems, including social problems, is exclusively of a technical nature. Regarding the lack of scientific knowledge of particular social groups as being an expression of a cultural gap or a cultural lag with respect to that of the elites, presupposes a particular social and political agenda: that both groups, both the elites and the rest, *should* share the same fundamental scientific culture, in fact, they should share the culture of the elites. Such an attitude, shared by the large majority of scientists and science communicators is a presupposition heavy with all kinds of political connotations. In attempting to bridge gaps among different social groups, science popularization turns out to be a process of legitimizing new power relations between the elites and other social groups, and popularization turns out to be a process of political elaboration and social appropriation of the authority of science. Hence, an implicit agenda of much of popularization is that the elites and the rest will share the same knowledge *and* they will, also, share the same values about the significance of this knowledge. And such an agenda constitutes another aspect of the hegemonic ideology. Something along similar lines was convincingly argued in 1977 by Steven Shapin and Barry Barnes in their article on one form of popular institute; they showed that the curricula of the Mechanics' institutes in 19th century Britain were a way for social control of those being educated. Though workers were taught technical skills, the aim of the educators was to make them "more docile, less troublesome, and more accepting of the structure of the emerging industrial society."⁷ In other words, the people attending the Mechanics' institutes courses, were taught not only technical skills, but by being taught those, the workers were imbued with all

⁷ Steven Shapin, Barry Barnes, "Science, Nature and Controls: Interpreting Mechanics' Institutes", *Social Studies of Science* 1977, 7: 31-74, on p. 32.

kinds of values – values the net effect of which would be to make the working class in harmony with the dominant ideology.

Let us consider technocracy, where science and its multifarious applications are considered to be the key to progress, to the alleviation of all social ills and to the solution of all social problems. Interestingly, until about the late 1960s many Marxists and non-Marxists alike shared the same outlook about science. They both believed that science itself was a neutral enterprise but differed in the practical applications and uses of science. The neutrality of science and the belief that its ideological and political aspects are materialized only when science is applied has been the fundamental tenet of technocracy. Such an attitude helped underline the view that the solutions of social problems were of an exclusively technical character, promoted by technocrats who are supposed to be thinking objectively and have the necessary knowledge. This view was, for many decades, shared by people who had differing views on a host of other aspects of social and political life. Thus technocracy, for many decades, has been an unchallenged hegemonic world view and science popularization was one of the main mechanisms which guaranteed the perpetuation of such hegemony.

But by the early 1970s there were serious changes in the world. The environmental crisis and then the energy crisis started to challenge technocracy. The pillar of technocracy that more science and more technology will bring more progress for all, did not anymore sound as convincing as it sounded a decade earlier. And the Vietnam War which ended in 1975 with the defeat of the USA, among many other things, underlined two things: first the case that perhaps for the first time in the history of humanity a military power is defeated without being able to use the ultimate weapon it possesses⁸; and, secondly, in the United States and generally in the West, scientists started to criticize strongly other scientists for their involvement in the war. Scientists ceased to be what after World War II appeared to be a homogeneous whole. Of course, the question of nuclear armaments had created serious disagreements among the scientists as soon as World War II ended. But these disagreements did not lead to serious doubts of the ways science was produced and applied. The Vietnam War in the context of all the other problems where scientists had played a prominent role seems to have been catalytic in bringing about a widespread current of criticism on the ways science was produced and applied.

⁸ The Korean War of 1950 and 1953 “does not count” since the result was a stalemate and formally it was a war between North and South Korea.

Especially in the USA, the universities and research institutes, the funding bodies, the various committees whose existence was known but their deliberations were kept secret, a number of Federal Agencies came under severe attack and their role was questioned. Interestingly, the most vocal agents of this criticism were scientists. Eventually there were deep divides within the scientific communities – divides which, if anything, have been accentuated over the years. New power relations were formed, academic politics took a new turn, and US Defense funding was no longer available to almost everyone, independent of what kinds of problems they were investigating.⁹

So the environmental and energy crises, and the defeat of the USA in South Vietnam, brought to the public sphere new groups of scientists, many of them rather critical of the way science was being practiced. The 1970s saw the formulation of new models of economic development, the discussion of alternative ways for progress, there was a redefinition of the moral responsibilities of the scientists, and slowly a different view towards science and its possibilities was being articulated. For example, the notion of sustainable development and the notion that there are limits to growth, all have their beginnings in the 1970s.¹⁰ It appeared that not all scientists shared the same values, and that many scientists criticized other scientists as to their moral stand *vis a vis* the use of the science they practiced. There was no more consensus that science and technology were a solution to all the problems, and many people started voicing their concern that science and technology as they were practiced, were no more part of the solution to many problems but part of what created those problems. Scientists became deeply divided, since within the new framework conditioned by these new social realities, the science they were producing and practicing entered a period of a deep crisis. Its authority was shaken and its credibility doubted. And, thus, technocracy as it was historically formulated, ceased to be the unchallenged hegemonic ideology. It continues, of course, to be dominant, but its position as a hegemonic ideology is becoming progressively more and more precarious.

The extensive science popularization undertaken in the post-World War II era had another important aim: the formulation and legitimization of a utopia. In the fifties and sixties it was the utopia of a world of cheap and limitless energy for all. And

⁹ Kelly Moore, *Disrupting Science: Social Movements, American Scientists, and the Politics of the Military, 1945-1975*, (Princeton University Press, 2008)

¹⁰ Donella Meadows, Dennis L. Meadows, Jorgen Randers, Eillima W. Behrens III, *The Limits to Growth* (Universe Book, 1972). The studies appearing in the book were funded by the Volkswagen Foundation and the work was commissioned by the Club of Rome. For a different perspective see, also, Steven Rose and Hilary Rose, *Science and Society* (Penguin, 1970) and Barry Commoner *The Closing Circle: Nature, Man, and Technology* (Knopf, 1971).

utopias are heavily ideological entities. A hegemonic ideology implies some kind of utopia, and a utopia is closely identified with a hegemonic ideology. Science popularization appears to be absolutely pivotal in accelerating this process and creating a peculiarly reciprocal relationship. Historically at least, science popularization has been articulating the characteristics of utopias which, in turn, are used to further legitimize ideological trends, and as these trends become entrenched in society, utopias become even more dominant and need further help from science popularization, etc. Hence, science popularization, utopias, hegemonic ideologies seem to be intractably intertwined. The ideology of technocracy so closely associated with the post-WWII hegemonic ideology and the utopia of a world with endless supplies of cheap energy, needed to be continuously revamped, needed to be continuously legitimized through a host of specific success stories. But by the early 1970s there were fewer and fewer success stories to come by. The various crises of the 1970s brought about the need for another dominant paradigm in science. In cultural terms physics and the atom could no longer command the necessary credibility in order to continue to have the authority which was so necessary for the dominant ideology. What was so systematically constructed since the end of WWII was in urgent need of change. Slowly, biology and the gene replaced physics and the atom.

Let me mention a word of caution before I continue: when one is dealing with these issues one has to be doubly careful; there is no conspiracy theory. Nor are the people who popularize science part of a big plot to lead us all to a hideous world. The phenomenon we are discussing is the complex issue of vying for hegemony, of legitimizing ideologies, and the role of science in all this. And what I am trying to point out, is that both science itself as well as its popularizations are being practiced in societies where the struggle for hegemonic ideology is continuously on the political agenda of different social groups, and that both science and its popularizations cannot be considered to be isolated from such contentions for hegemony.

The new paradigm, the movement away from physics and the atom into biology and the gene, was accompanied by attempts to associate with it a new utopia: a world without diseases; a world with plenty of food for everyone. Let us attempt to probe into some characteristics of what many popularizes call the 'miracles' of molecular biology. Almost every day in almost every media we come across small or big successes of molecular biology. Whether it is a new cure for cancer, or the discovery of the gene for obesity or for jealousy, we are continuously reminded that most of our problems will be understood and solved through the triumphs of

molecular biology. But what has been the net effect of popularization or the circulation of knowledge about molecular biology? It appears that the popular ‘understanding’ of the issues involved in biological research has been the conviction of a reductionist view that everything is in the genes. What has been successfully communicated is not the complicated microscopic processes, but the overall attitude that whatever is going to happen to us has somehow been codified in our genes. Or that if it is not the case, then it is conceivable that genes can be properly manipulated to give the wished-for result. Never mind that biologists and other scientists have been telling us at every opportunity that biological research has, in fact, undermined such reductionism and a number of molecular biologists have been insisting that every finding about a particular gene has to be assessed in the context of all the other genes.¹¹ But the *public perception* of biological research is heavily anchored in reductionism. And such reductionism has been the net outcome of popularization attempts. Reductionism far from being a methodological or even a philosophical topic, has, over the years, become part of an ideology, which emphasizes that the problems one is facing have been in the genes all along. One is jealous, one is obese, one is antisocial, one will have all kinds of diseases because everything is in the genes, and thus, reductionism is no longer a technical issue, something which shows a sloppy methodology or naive philosophy. If over the years, reductionism has become an ideological category, then the processes of popularization that places emphasis on the significance of reductionism, have themselves acquired a rather intense ideological character.

There is, of course, a kind of methodological counterargument. If most writers could write better, if there was a concerted effort to educate people on these matters, if people’s education had been such that these relatively complicated matters could form the proper background for popular texts etc., things would be dramatically better and reductionism would not be so dominant in the public perception of molecular biology. However, this is not a valid counterargument, since it relegates all to a hypothetical situation and we are interested in understanding the present and the present has the characteristics I have tried to describe. The point is not to understand what would have happened under different conditions, but to understand what is actually happening. It is indeed the case that there are many bad writers who have an incomplete understanding of what they are writing about, and in

¹¹ Many of the arguments can be found in Evelyn Fox Keller *The Century of the Gene* (Harvard University Press, 2000).

many newspaper articles and television programmes, the bottom line is that they want to impress with the pictures they show rather than to convey information, which could then be further processed. The question of the relationship of ideology to science popularization cannot be relegated to the technical insufficiencies of writers or editors, but to the very processes of science popularization, which comprise part of the complex processes of rearticulating the hegemonic ideology.

In our day, perhaps one of the most intriguing challenges is the inherent impossibility to identify unambiguously what constitutes popular scientific writing. I would like to consider further the relationship of ideology to science popularization in a particular category of writings. These are texts which appear in professional journals, but they are not necessarily addressed to only members of one particular community compared to the more specialized articles in these journals. In many journals (such as the *Bulletin of Atomic Scientists*, *Nature*, *Science* and *Scientific American*), in addition to such specialized articles, there are also specific kinds of article that have a long history of addressing themselves to a larger, more heterogeneous scientific audience: editorials, policy notes, review articles, obituaries, and news. Surely these are not popular writings in the traditional sense but nevertheless they do play a role similar to that of science popularization: they present the state of affairs of particular disciplines; they express worries and criticisms of excesses attempting to veer things back to 'where they should be'; and, mostly, by narrating successes, they reiterate that, despite problems, 'things are basically OK'.

Let me give an example from the publications of one scientist and his collaborators. James Fowler, who is well known for his theory of (social) networks, is currently Professor of Medical Genetics in the School of Medicine and Professor of Political Science in the Division of Social Sciences at the University of California at San Diego, USA. Together with his collaborator Nicholas Christakis, they were in the list of top 100 global thinkers of the magazine *Foreign Policy*.¹²

In an article in the *American Political Science Review* entitled "Genetic Variation in Political Participation", Fowler et al. consider the problem of how one decides who to vote for. They claim that their study shows that "a significant proportion of the variation in voting turnout can be accounted for by genes", claiming that these findings suggest for the first time that "humans exhibit genetic variation in their tendency to participate in political activities." They mention that it appears

¹² *Foreign Policy*, December 2010, <http://www.foreignpolicy.com/issues/183/contents> (accessed on January 25, 2013).

unlikely that there may be a 'voting gene', nevertheless they emphasize that, in combination with environmental factors, there may be a "set of genes whose expression regulates political participation."¹³ In another article in the *Journal of Politics* with the title "Two Genes Predict Voter Turnout" Fowler and Dawes claim to have shown that "individuals with a polymorphism of the MAOA gene are significantly more likely to have voted in the 2004 presidential election."¹⁴ Significantly in an essay in *Science*, appearing in the column called *Perspectives* and titled "Biology, Politics, and the Emerging Science of Human Nature," Fowler and Schreiber attempt to synthesize what appeared to be the disparate aims of brain research and political science. The authors claim that "these separate fields of inquiry are subject to inherent limitations that may only be resolved through collaboration across disciplines. We describe recent advances and argue that biologists and political scientists must work together to advance a new science of human nature."¹⁵

In the cases I presented, and a host of others which spring from articles in learned or professional journals, the writers have an undoubted expertise about what they are writing about. They write clearly and they write well. The aims of these articles are similar to the aims of science popularization: to communicate new developments and to present new agendas. The 'end result' of such articles is, also, rather similar to what a host of articles of science popularization achieve: to forge allegiances, to create audiences, to push research agendas, to intervene in academic politics. In other words, such articles are part of the means for the contention for ideological dominance as to the character of social problems and the kind of science that will provide answers. Whereas many scholars stress the absolutely crucial role of environment in its most general sense in our everyday lives, a reductionist approach, which explains not only diseases and psychological traits but also social and political behavior, becomes a particularly strong counterargument to those who insist on the role of the environment. And this counterargument draws its strength from the authority of molecular biology. Of course, many of these scientists who try to legitimize such an approach are quick to point out the non-negligible role of the environment. The public perception, though, of what is being communicated makes

¹³ James Fowler, Laura Baker, Christopher Dawes, "Genetic Variation in Political Participation", *American Political Science Review*, May 2008, 102: 233-248, quotes from p.233.

¹⁴ James H. Fowler, Christopher T. Dawes, "Two Genes Predict Voter Turnout," *Journal of Politics*, July 2008, 70: 579-594, quote on p.579.

¹⁵ James H. Fowler, Darren Schreiber, "Biology, Politics, and the Emerging Science of Human Nature," *Science*, 7 November 2008, 322: 912-914, quotes from p.912.

such a reference to environment rather opaque – and when one is talking about the kinds of articles I attempt to analyze, it is this net effect which is the decisive factor in the public perception of what is at stake.

The argument about the relationship of science popularization and hegemonic ideology is not only confined to such cases as above. One can trace such a relationship in more politically explicit aspects as well.

In much the same manner as the cases I discuss above, there is a recent analogous case to be noted in Europe. The issue is the much contested notion of European science. Europe is presently in the throes of its most dramatic transformations since the end of the Second World War – there are new political realignments and a strong contention for political and ideological hegemony. Interestingly, the notion of European science is playing a rather prominent role in all this.

In a 1995 European Commission White Paper on the question of unemployment and on the ways young people can gain as many skills as they need before finishing high school, the European Union proposed that history of science and technology be included in the school curricula. It was no doubt a good recommendation but for the wrong reasons.¹⁶ The White Paper suggested that by learning the history of science, and especially the history of technology, young people will acquire knowledge of a variety of skills and techniques and will become aware of the boundlessness, as it were, of human inventiveness. The recommendation of the report, however, is embedded in one of those interesting mental somersaults that the bureaucrats in Brussels are so fond of performing. It was noted that science had been a European phenomenon, that modern science was born in Europe and that it should be taken as our common European heritage and, hence, all schoolchildren should become aware of the history of European Science.

Here is one of those instances where there is such a dramatic dichotomy between bureaucratic goals and the aims of an academic pursuit. Never mind that historians of science have been trying to articulate local differentiations and trying to bring to the surface the deviations from the viewpoint that holds scientific enterprise to be an all-inclusive homogeneous practice. European integration as planned in Brussels needs ‘European’ notions and the construct of European science will continuously be seeking legitimization. There is such a construction of European

¹⁶ White Paper published by the European Commission entitled *Teaching and Learning: Towards the Learning Society* (Luxembourg, 1995). See sections II.B and C.

science in the kinds of articles I have been looking at, in the introductory passages in the Framework Programs, which are the research programs of the European Union, and in many science policy papers. Recently an article published in *Science* was entitled “From ‘Science in Europe’ to ‘European Science’.” It cannot be more explicit in its aim, which is to argue for such a transition.¹⁷

The point I want to make is that political agendas are being formulated in terms of scientific entities or concepts that appear neutral in order to lend legitimacy to the politics involved. The highly problematic notion of European science appears sufficiently innocent yet it codifies specific power relations, and, thus, it becomes a rather effective means of reconfiguring the hegemonic ideology.

It is one thing to consider the word ‘European’ to denote a geographical reference but it is a dramatically different choice to give to the same word a cultural reference. In fact, the legitimization of the concept of ‘European Science’ has been one of the aims of all those who have been formulating the hugely funded European research projects. Long gone are the days when the concept of science in Europe was considered to be sufficiently self-explanatory. The attempts at political unification of Europe have blatantly failed, and what was envisaged as political unity has degenerated into turning Europe into a mere (but fractionated) economic entity. And since political unity cannot be achieved within the context of such strong nationalistic discourses as those in Europe today, what is being sought is new ways to give further legitimacy to a failed political strategy. Since political union is virtually impossible, the emphasis now is to propagandize at all levels of society the one thing that most social groups will accept as unproblematic and will not react against: that there is a European Science. The notion of European Science looms large and it is being continuously reconstructed and rearticulated. Now European Science is no longer science in Europe, it is no longer science situated geographically in Europe, but it is the science *of* Europe. And, thus, the notion of European Science being under continuous negotiation and reconfiguration, is vying for dominance, is part of the struggle for becoming the means for the contention of a hegemonic ideology. Of course, such a notion was nurtured for many decades by many historians of science in order to unfold the success story of science, and to construct a narrative of how this European Science migrated to other places like China and Latin America. But the

¹⁷ Maria Nedeval, Michael Stamfer, “From ‘Science in Europe’ to ‘European Science’,” *Science*, 25 May 2012: vol. 336, n. 6084: 982-983.

emphasis on it as a quasi-political category overshadows the serious inhomogeneities present in the development of the sciences in Europe since the 17th century.

There are, in a way, two kinds of ideologies involved in the process of popularization: one is the ideology expressed by the very act of popularization, by the enterprise to popularize itself; the second is the ideology imbedded in what is being popularized, in the kind of science that is being popularized, in the appropriate discourse used for the popularization of science. And I want to emphasize that although the first kind, that which is expressed by the act of popularization, is rather clearly manifested and easily discernible, the second one, which has to do with the content of what is being popularized, is usually opaque and almost always neglected. Of course, the hegemonic ideology does not involve a static and unchanging set of values. It needs continuous revamping since a particular ideology needs to be reinforced in order to be lasting. Popularization, or rather the ideology of popularization, is one such means. And, thus, the popularization of ideology affects in turn the ideology of popularization.

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THE JOURNAL *BROTÉRIA* (1902-2002): JESUIT SCIENCE IN THE 20th CENTURY

*Francisco Malta Romeiras**

Introduction

In the past few years, historians of science have been studying the role played by the Jesuits in science teaching and communication during the 16th, 17th and 18th centuries, in order to better understand their contributions to science in this period.¹ The Society of Jesus, officially established in 1540 by Ignatius of Loyola, was fundamental in the teaching and transmission of scientific knowledge in Portugal, namely through a network of schools established during the 16th century in Lisboa, Évora and Coimbra.² For example, the College of Santo Antão, established in Lisbon in 1553, offered a course on mathematical sciences known as the *Aula da Esfera* — 'class on the sphere' — from 1590 until 1759, which is considered nowadays a landmark in the teaching of mathematics in Portugal.³

In the mid-18th century, however, the Marquis of Pombal (1699- 1882) launched a campaign against the Society of Jesus by accusing the Jesuits of being illiterate and the main cause of Portuguese backwardness. Within this campaign hundreds of books, treatises, pamphlets, reports and plays were published in Portugal and largely diffused in Europe, causing the banishment of the Jesuits from Portugal, in 1759.⁴ This political campaign influenced the banishment of the Society of Jesus in France (1764), Spain (1767), Two Sicilies (1767) and Parma (1768) and fuelled the Vatican's suppression of the Order, in 1773, by the Pope Clement XIV.⁵ From its

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¹ Some reference works on Jesuit Science: Ugo Baldini, *Legem impone subactis. Studi su filosofia e scienza dei Gesuiti in Italia. 1540-1632*, Bulzoni, Roma, 1992; Mordechai Feingold (ed.), *Jesuit Science and the Republic of Letters*, The MIT Press, Cambridge MA, 2003; Mordechai Feingold (ed.), *The New Science and Jesuit Science: Seventeenth Century Perspectives*, Kluwer Academic Publishers, Dordrecht, 2003; Marcus Hellyer, *Catholic Physics: Jesuit Natural Philosophy in Early Modern Germany*, University of Notre Dame Press, Notre Dame, Indiana, 2005.

² John O'Malley, Gauvin A. Bailey, Steven J. Harris and T. Frank Kennedy (eds.), *The Jesuits. Cultures, Sciences, and the Arts, 1540-1573*, University of Toronto Press, Toronto, 1999.

³ Henrique Leitão, *A Ciência na Aula da Esfera no Colégio de Santo Antão, 1590-1759*. Comissariado Geral das Comemorações do V Centenário do Nascimento de S. Francisco Xavier, 2007.

⁴ José Eduardo Franco & Christine Vogel, "Um acontecimento mediático na Europa das Luzes: A propaganda antijesuítica pombalina em Portugal e na Europa", *Brotéria*, 169, 2009, 349-506; José Eduardo Franco. *O Mito dos Jesuítas. Em Portugal, Brasil e Oriente. (Séc. XVI a XX)*. Gradiva, Lisboa, 2006. The main books published during this period were: *Relação abreviada* (1757), *Erros ímpios e sediciosos* (1759), *Dedução cronológica e analítica* (1767-68) and *Compendio Historico do Estado da Universidade de Coimbra* (1771).

⁵ Bertrand Roehner, "Jesuits and the State: A Comparative Study of their Expulsions (1590-1990)", *Religion*, 27, 1997, 165-182; The Society of Jesus was suppressed by Clement XIV in the Papal Brief *Dominus ac Redemptor*.

suppression until its re-establishment, in 1848, the Portuguese intellectual elite took Pombal's judgment for granted: "The Jesuits were the most significant mark of backwardness in Portugal".⁶ This line of reasoning, which perpetuated throughout the 19th and 20th centuries, justifies this historiographical void — the scientific activities of the Society of Jesus in this period remaining utterly unexplored. Nevertheless, in Portugal, the Jesuit colleges of Campolide (Lisboa, 1858) and São Fiel (Lourical do Campo, 1863) were two of the most relevant secondary schools that made important efforts in science pedagogy and popularization, namely through the scientific journal *Brotéria*, as it has been briefly described elsewhere.⁷

Despite the existence of a multitude of documents pertaining to experimental practice and science pedagogy at the colleges of Campolide and São Fiel, the historical analysis of the role played by these colleges in Portuguese history of science still remains quite inadequate.⁸ On the other hand, the journal *Brotéria* has encouraged the emergence of complex historical narratives that focus mainly on the relevance of the religious context in the 19th century for the foundation of a scientific journal by the Portuguese Jesuits, in 1902.⁹ Despite their sheer importance, however, these studies still lack a historical analysis of the scientific activities of the Portuguese Jesuits in the 19th and 20th centuries. The single exception is the work of João Paulo Cabral, who establishes the importance of the scientific correspondence of Portuguese Jesuits and the botanist Gonçalo Sampaio (1865-1937) for the development of Botany in Portugal, between 1902 and 1920.¹⁰

⁶ José Eduardo Franco, "História da Brotéria (1902 – 2002)", pp. 90-142 in Hermínio Rico S.J. & José Eduardo Franco (eds.) *Fé, Ciência, Cultura: Brotéria-100 anos*, Gradiva, Lisboa, 2003.

⁷ Francisco Malta Romeiras & Henrique Leitão, 2012, "Jesuítas e Ciência em Portugal. IV - A revista *Brotéria - Ciências Naturais* e a sua recepção nacional e internacional", *Brotéria*, 174, 2012, 323-333; Francisco Malta Romeiras & Henrique Leitão, "Jesuítas e Ciência em Portugal. III - As expedições científicas e as observações dos eclipses solares de 1900 e 1905", *Brotéria*, 174, 2012, 227-237; Francisco Malta Romeiras & Henrique Leitão, "Jesuítas e Ciência em Portugal. II - Carlos Zimmermann S.J. e o ensino da Microscopia Vegetal", *Brotéria*, 174, 2012, 113-125; Francisco Malta Romeiras & Henrique Leitão, "Jesuítas e Ciência em Portugal. I - António Oliveira Pinto S.J. e as primeiras experiências com Radioactividade em Portugal", *Brotéria*, 174, 2012, 9-20.

⁸ Jorge Custódio, *O Colégio de Campolide*, Universidade Nova de Lisboa, Faculdade de Economia, Lisboa, 1988; Ernesto Candeias Martins, "Do Colégio de S.Fiel a Reformatório (séculos XIX-XX). Contributos à Re(educação) em Portugal", *Anais do VI Congresso Luso-Brasileiro da História da Educação*, 2006, pp. 826-851; João Mendes Rosa, *Colégio de S. Fiel*, GAAC - Grupo de Arqueologia e Arte do Centro, Coimbra, 2004; Maria Adelaide Neto Salvado, *O Colégio de São Fiel: centro difusor da ciência no interior da Beira*. Samedo - Soc. Tipográfica, Castelo Branco, 2001.

⁹ José Eduardo Franco, *História da Brotéria e da evolução do seu pensamento pedagógico*, Roma Editora, Lisboa, 1999; Hermínio Rico S.J. & José Eduardo Franco (eds.), *Fé, Ciência, Cultura: Brotéria-100 anos*, Gradiva, Lisboa, 2003.

¹⁰ João Paulo Cabral, "La revista Brotéria, los jesuitas naturalistas y Gonçalo Sampaio. Intercambio de plantas e ideas y el desarrollo de la botánica en Portugal", *Asclepio: Revista de Historia de la Medicina y de la Ciencia*, 62, 2010, 61-92.

Hence, the main objective of my doctoral research is to analyse systematically the scientific activities of the Portuguese Jesuits in the 19th and 20th century, thus providing a historical narrative that should be incorporated in the studies about science pedagogy and popularization in the European periphery. I intend to scrutinize the role played by the colleges of Campolide (1858-1910) and São Fiel (1863-1910) and by the journal *Brotéria* (1902-2002), namely through the analysis of its scientific publications, in a broader narrative of 19th and 20th centuries Portuguese history of science, by specifically describing the importance of Portuguese Jesuits to the development of physics, astronomy, botany, zoology, biochemistry and molecular genetics in Portugal.

It is also my intention to correlate this scientific endeavour of the Jesuits in Portugal with the charges of scientific backwardness that perpetuated since the 18th century. Moreover, I expect to integrate this scientific enterprise with the main pedagogical documents adopted by the Society of Jesus since the 16th century¹¹ and provide novel insights on the relationship between science and power in the Portuguese context, in three different political regimes: the Constitutional Monarchy (1858-1910), the Portuguese First Republic (1910-1926) and the Dictatorship (1926-1974). In this HoST "work in progress", however, I shall focus only on a brief history of the journal *Brotéria*.

THE JOURNAL *BROTÉRIA*

Established by Joaquim da Silva Tavares S.J. (1866-1932), Cândido Azevedo Mendes S.J. (1874-1943) and Carlos Zimmermann S.J. (1871-1950), teachers of the Jesuit college of São Fiel (Lourçal do Campo), in 1902, and with more than 1300 research papers on zoology, botany, biochemistry and molecular genetics, this scientific journal was one of the most relevant learned journals in Portugal, in the 20th century.¹² In order to better understand its significance in the Portuguese and international contexts, I shall focus on some details associated with the origin of this journal and its main achievements, in the 20th century. I shall start with the religious

¹¹ *Monumenta Ignatiana. Sancti Ignatii de Loyola Constitutiones Societatis Iesu*, Rome, Institutum Historicum Societatis Iesu, 1948; *Monumenta Paedagogica Societatis Iesu. V: Ratio atque Institutio Studiorum Societatis Iesu (1586, 1591, 1599)*, Institutum Historicum Societatis Iesu, Rome, 1986.

¹² Francisco Malta Romeiras & Henrique Leitão, "Jesuítas e Ciência em Portugal. IV - A revista *Brotéria* - *Sciências Naturaes* e a sua recepção nacional e internacional", *Brotéria*, 174, 2012, 323-333; Hermínio Rico S.J. & José Eduardo Franco (ed.), *Fé, Ciência, Cultura: Brotéria-100 anos*, Gradiva, Lisboa, 2003. All the statistics concerning *Brotéria* are available on: http://webpages.fc.ul.pt/~fmromeiras/Broteria_/Estatisticas.html. "S.J." stands for "Society of Jesus" and always follows the name of a Jesuit priest.

and historical context that was behind the foundation of this learned journal by the Society of Jesus, in Portugal.

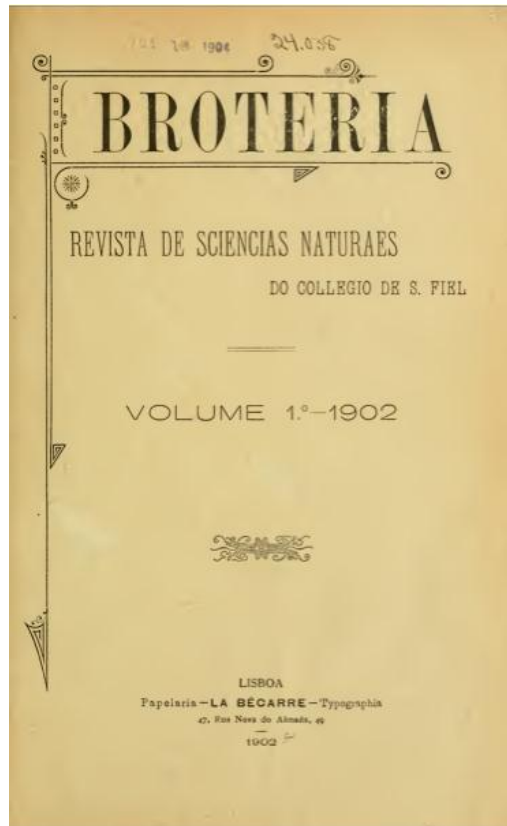


Figure 1 - Cover of the first issue of the journal *Broteria-Sciencias Naturaes*, 1902.

In the 19th century, Portuguese anticlericalism had reached a critical peak.¹³ The controversies between laymen, especially scientists and politicians, and the clergy were frequent in this period. The positivism of Auguste Comte (1798-1857) influenced the public discourses and the official documents of some of the most distinguished Portuguese politicians such as Adolfo Coelho (1847-1919) and Antero de Quental (1842-1891).¹⁴ Portuguese Jesuits were also part of this intricate plot, and one of the most relevant quarrels of this period, on the origin of man, implicated the famous republic physician Miguel Bombarda (1851-1910) and the Jesuit priest Manuel Fernandes Santana S.J. (1864-1910).¹⁵

¹³ Carlos Moreira Azevedo (ed.), *História religiosa de Portugal*, Círculo de Leitores, Lisboa, 2002; Artur Vilarés, *As congregações religiosas em Portugal, 1901-1926*, Fundação Calouste Gulbenkian e Fundação para a Ciência e Tecnologia, Lisboa, 2003; José Eduardo Franco, *O Mito dos Jesuítas. Em Portugal, Brasil e Oriente. (Séc. XVI a XX)*, Vol. 2, Gradiva, Lisboa, 2006, pp. 90-98.

¹⁴ Adolfo Coelho, *A Questão do Ensino*, Porto, 1872; Antero de Quental, *Defesa da Carta Encíclica de Sua Santidade Pio IX contra a chamada Opinião Liberal. Considerações sobre este documento*, Imprensa Literária, Coimbra, 1865.

¹⁵ Artur Anselmo (ed.), *As grandes polémicas portuguesas*, vol. II, Verbo, Lisboa, 1967, p. 364.

In this anticlerical atmosphere, some of the most notorious politicians were constantly demanding the closure of the Jesuit colleges at the Portuguese Parliament, by arguing that the Society of Jesus was the main responsible for scientific backwardness in Portugal. This was the same line of argument used by the Marquis of Pombal, back in 1759, when he expelled the Jesuits from all Portuguese territories; only recently has this received view been object of revision.¹⁶ All these public discourses and documents culminated with the suppression of the Society of Jesus in Portugal on 8 October, 1910, only three days after the republican revolution.¹⁷ The imprisonment and proscription of Portuguese Jesuits, however, was not the most adverse consequence of the republican revolution. With the suppression of the Society of Jesus, the colleges of Campolide (1858-1910) and São Fiel (1963-1910) were bombed and violently invaded by rebels, who destroyed scientific instruments and invaluable manuscripts and books.¹⁸ The scientific and pedagogical legacy that Portuguese Jesuits were developing since the 1850's was irremediably lost. These colleges were amongst the most significant pre-university institutions in Portugal, from 1858 to 1910. In these secondary schools, the Jesuits promoted an experimental approach to the teaching of botany, zoology, physics, chemistry and astronomy¹⁹ — a landmark in the Portuguese historical context.²⁰

Besides teaching the natural sciences, especially since the early 20th century, the Jesuits in Portugal were particularly concerned with the development of botany and zoology, their main domain of expertise in this period, having described and classified more than 2200 new species in the journal *Brotéria*, from 1902 to 1979.²¹ In

¹⁶ Francisco Malta Romeiras & Henrique Leitão, "Jesuítas e Ciência em Portugal. V - Os Colégios de Campolide e de São Fiel e a implantação da República", *Brotéria*, 174, 2012, 425-440.

¹⁷ Decree of the Portuguese Republic, 8/10/1910.

¹⁸ Francisco Malta Romeiras & Henrique Leitão, "Jesuítas e Ciência em Portugal. V - Os Colégios de Campolide e de São Fiel e a implantação da República", *Brotéria*, 174, 2012, 425-440.

¹⁹ Francisco Malta Romeiras & Henrique Leitão (2012) "Jesuítas e Ciência em Portugal. III - As expedições científicas e as observações dos eclipses solares de 1900 e 1905", *Brotéria*, 174, 2012, 227-237; Francisco Malta Romeiras & Henrique Leitão, "Jesuítas e Ciência em Portugal. II - Carlos Zimmermann S.J. e o ensino da Microscopia Vegetal", *Brotéria*, 174, 2012, 113-125; Francisco Malta Romeiras & Henrique Leitão, "Jesuítas e Ciência em Portugal. I - António Oliveira Pinto S.J. e as primeiras experiências com Radioactividade em Portugal", *Brotéria*, 17, 2012, 9-20.

²⁰ Jorge Ramos do Ó, *O Governo de si mesmo: Modernidade pedagógica e encenações disciplinares do aluno liceal (último quartel do século XIX—meados do século XX)*, Educa, Lisboa, 2003, Jorge Ramos do Ó, *Ensino liceal (1836-1975)*, Ministério da Educação, Lisboa, 2009; Maria Cândida Proença, *A reforma de Jaime Moniz: Antecedentes e destino histórico*, Tese de Doutoramento, Universidade Nova de Lisboa, Lisboa, 1993, António Nóvoa, João Barroso & Jorge Ramos do Ó, "O todo poderoso Império do Meio", in António Nóvoa & Ana Teresa Santa-Clara (ed.) *Liceus de Portugal*, Asa, Porto, 2003, Inês Gomes, "Os Gabinetes de História Natural dos antigos liceus - um estudo exploratório a partir dos textos legislativos" in *Actas do Congresso Luso-Brasileiro de História das Ciências*, 2011.

²¹ *Índices Gerais da Brotéria Científica [1902-2002]*, Brotéria Genética, Braga, 2002. All the statistics concerning Brotéria are available on the website: http://webpages.fc.ul.pt/~fmromeiras/Broteria_/Estatisticas.html.

fact, this scientific orientation of taxonomic identification and description of plants and animals was closely associated with the work of the prominent Portuguese naturalist Felix Avelar Brotero (1744-1828) to whom the journal was dedicated.

Moreover, with the foundation of this journal, Portuguese Jesuits intended to reverse positivistic discourses and establish that there was no incompatibility between science and faith. There was also the will to contradict the popular belief that it was impossible for the Jesuits to achieve relevant and innovative scientific knowledge. Only with this particular enterprise could the Society of Jesus recover its scientific reputation, which had been completely shattered since the 18th century.²² In a broader perspective, one can interpret the foundation of *Brotéria* as part of a larger strategy of an apostolic endeavour, which had included the foundation of various Portuguese Catholic organizations such as the *Centro Académico de Democracia Cristã* (1901). It is also impossible to detach *Brotéria* from other Portuguese spiritual periodicals of the Society of Jesus such as the *Mensageiro do Coração de Jesus* (1881) and the *Legionário de Maria* (1905), or from European cultural journals like *La Civiltà Cattolica* (Italy, 1850), *Études* (France, 1856) and *Razón y Fé* (Spain, 1901).

Brotéria, in addition, should be included in a broader cluster of scientific periodicals, which had been published in Portugal since the 18th century. The most relevant of these journals were *Memórias de Agricultura* (1788-1791), *Memórias Económicas* (1789-1815), *Memórias da Academia Real das Sciencias de Lisboa* (1797-1856), *Jornal de Sciencias Mathematicas, Physicas e Naturais* (1866) and *O Instituto: Revista Científica e Literária* (1852-1981).²³ The journal closer to *Brotéria* was, however, the *Boletim da Sociedade Broteriana* (Coimbra, 1883), founded and directed by Júlio Henriques (1838-1928). Like *Brotéria*, this journal presented to its public original papers identifying and describing new botanical species. Júlio Henriques and Portuguese Jesuits cooperated intensively in the identification and description of botanical species, in particular, in the period between 1902 and 1932, as it has been described elsewhere.²⁴

Between 1902 and 1932, under the direction of Silva Tavares, Jesuit naturalists focused primarily on the identification and classification of novel botanical

²² José Eduardo Franco, "História da Brotéria (1902-2002)", in Hermínio Rico S.J. & José Eduardo Franco (eds.), *Fé, Ciência, Cultura: Brotéria-100 anos*, Gradiva, Lisboa, 2003.

²³ José Eduardo Franco, "História da Brotéria (1902-2002)", in Hermínio Rico S.J. & José Eduardo Franco (eds.), *Fé, Ciência, Cultura: Brotéria-100 anos*, Gradiva, Lisboa, 2003.

²⁴ António José Leonardo, *O Instituto de Coimbra e a evolução das ciências físico-químicas em Portugal de 1852 a 1952*, PhD Thesis, Universidade de Coimbra, Coimbra, 2011.

and zoological species. Beyond this scientific programme, however, there was clearly an apostolic intention behind *Brotéria*, evident since its foundation. In the opening issue, the famous metaphor of the "Two Books" was revived, with the naturalists claiming that the main objective of this journal was the diffusion of their studies, which was also meant to awaken the interest in scientific research, in Portugal, and contribute to an improved understanding of God's mysteries, a typical agenda of natural theologians:²⁵

We rejoice with the idea that our contributions, as insignificant as they might be, can disseminate the taste for the natural sciences in our country. The natural world is a vast book, which has many pages to be opened. The name of our grand Creator is written on each of them. When opening these pages, what greater satisfaction could anyone have than unveiling the greatness of God, which is stamped equally on the immensity of the world and on the myriad of tiny animals and plants, whose existence only the microscope can uncover?²⁶

The journal *Brotéria* was founded with an educational and scientific purpose. Indeed, the scientific relevance of *Brotéria*'s articles on botany and zoology can be grasped not only from the numerous words of praise by Portuguese botanists such as Júlio Henriques and José Veríssimo d'Almeida (1834-1925), but also from the inclusion of new species described by Portuguese Jesuits in annual catalogues of scientific journals such as the *Boletim da Sociedade Broteriana*, the *American Naturalist* and the *Journal of Mycology*.²⁷

Five years following its establishment, in 1907, *Brotéria* was subdivided in three separate periodicals, *Vulgarização Científica* [Scientific Popularization], *Botânica* [Botany] and *Zoologia* [Zoology]. The journal *Brotéria-Vulgarização Científica*, entirely written in Portuguese, was especially designed to be profitable and in this way

²⁵ For the metaphor of the "Two Books" check Olaf Pedersen, *The Two Books - Historical Notes on Some Interactions Between Natural Science and Theology*, Vatican Observatory Foundation, Vatican 2007.

²⁶ "Duas palavras de introdução", *Brotéria*, I, 1902, V; Original transcription: "A ideia de concorrermos, por pouco que seja, para propagar o gosto das sciencias naturaes em nossa patria enche-nos de alegria. A natureza é um livro immenso, que tem ainda muitas folhas por abrir. Ora em todas ellas se encontra escrito o nome augusto do Creador. E será acaso pequena satisfação ao abril-as mostrar nellas a grandeza de Deus, que tanto se estampa na immensidade do mundo, como na extrema pequenez, de myriades de animaes e planas, cuja existencia só o microscopio nos revela?"

²⁷ Francisco Malta Romeiras & Henrique Leitão, "Jesuítas e Ciência em Portugal. IV - A revista *Brotéria-Sciencias Naturaes* e a sua recepção nacional e internacional", *Brotéria*, 174, 2012, 313-323; "Notes", *The American Naturalist*, 37(438), 1903, 438-442; "Notes", *The American Naturalist*, 38(447), 1904, 230-240; William Trelease, "Library contributions", *Missouri Botanical Garden Annual Report*, Vol. 1904, 1904, 87-129; W. A. Kellerman, "Notes from Mycological Literature. IX", *The Journal of Mycology*, 10(2), 1904, 81-90; W. A. Kellerman and P.L. Ricke, "New Genera of Fungi Published Since the Year 1900, with Citation and Original Descriptions (Continued)", *The Journal of Mycology*, 10(4), 1904, 199-223; "Index to American Botanical Literature (1904)", *Bulletin of the Torrey Botanical Club*, 32(7), 1905, 393-396; "Index to American Botanical Literature (1904-1907)", *Bulletin of the Torrey Botanical Club*, 35(12), 1908, 585-592.

cover the expenses of the specialised series *Zoologia* and *Botânica*, whose original articles written in English, French, German, Spanish, Portuguese and Latin, only interested Portuguese and foreign botanists and zoologists.²⁸ With more than 450 popularization articles published in chemistry, physics, agriculture, medicine and biology, *Vulgarização Científica* (1907-1925) was a successful Portuguese popularization journal during its 18 years of existence. In 1925, however, Silva Tavares decided to replace *Vulgarização Científica* for a cultural, philosophical and humanistic journal, which still exists today.

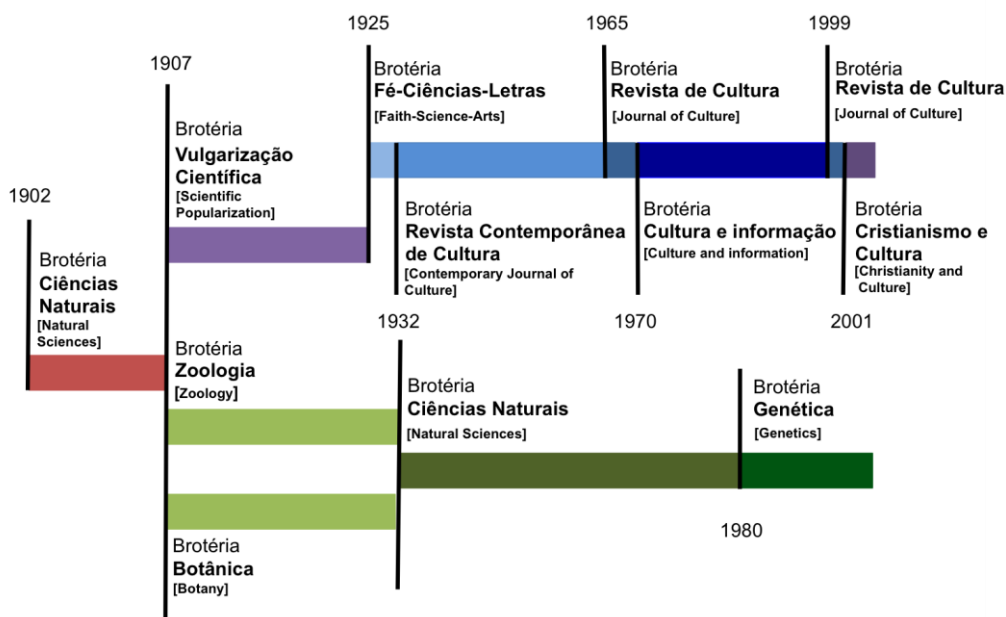


Figure 2 - Editorial evolution of the journal *Brotéria*. Adapted from Hermínio Rico S.J. and José Eduardo Franco (eds.), *Fé, Ciência, Cultura: Brotéria-100 anos*, Lisboa, Gradiva, 2003, p. 101.

Following the death of Silva Tavares S.J., in 1932, Alphonse Luisier S.J. (1872-1957) became the editor of *Brotéria*. This botanist specialized in bryology; he identified and described 18 new species and 13 new varieties of mosses. His important collections (*Bryotheca Europaea*, *Bryotheca Atlantica* and *Bryotheca Exótica*), can be seen nowadays at the Jesuit college *Instituto Nun'Alvares* (Caldas da Saúde, Santo Tirso).²⁹ While Luisier was the editor of *Brotéria*, especially between 1939 and

²⁸ "Prólogo", *Brotéria-Série de Vulgarização Científica* VI, 1907.

²⁹ J. Vaz de Carvalho, "Afonso Luisier", *Dicionário Histórico de la Compañía de Jesús*, Universidade Pontificia Comillas, Institutum Historicum Societatis Iesu, Madrid, Rome, 2001, pp. 2440-2441; Maria Luísa, "Recordando o Padre Luisier - Nos 40 anos do seu falecimento", *Brotéria - Genética* XVIII, 1997, 99-101; Luís Archer S.J., "Centenário do nascimento do P. Alphonse Luisier, S.J.", *Brotéria - Ciências Naturais*, 41, 1972, 1;

1957, a group of geneticists lead by António Sousa da Câmara (1901-1971), founder and director of the National Agronomic Station (*Estação Agronómica Nacional*) published several papers on plant genetics, thus showing that *Brotéria* was renewing itself and contributing to the scientific development of genetics and plant breeding in Portugal, a major line of research within the Dictatorship's scientific agenda.³⁰

Under the auspices of Luís Archer S.J., from 1962 to 1979, *Brotéria* published international papers on biochemistry, focusing on relevant and state-of-the-art issues such as cell metabolism, enzymatic activities and protein electrophoresis.³¹ Between 1965 and 1969, *Brotéria* published the doctoral dissertations of Francisco Guerra (1932-), Luís Archer and Roberto Salema (1932-), respectively on mitochondrial tumefaction, DNA-mediated transformation in bacteria, and biogenesis and structure of starch, thus disseminating the scientific work of these promising biologists.³² From the 1970s onward, *Brotéria* published the first papers on molecular genetics, the vast majority of which was written by foreign researchers, thus indicating the international influence of this scientific periodical of the Society of Jesus.³³ In addition, in 1980, subsequent to the exponential growth of a variety of fields of molecular genetics, Archer modernized the journal and created the *Brotéria-Genética*, thus integrating the need for a specialised journal on genetics in Portugal,

José Carvalhes, "Padre Alphonse Luisier", *Brotéria - Ciências Naturais*, 54, 1958, 3-16; José Carvalhes, "R.P. Alphonse Luisier, SJ, Homenagem ao cientista e ao mestre", *Boletim Cultural de Santo Tirso*, V, 1957, 223-249.

³⁰ Francisco Malta Romeiras & Henrique Leitão, "Jesuítas e Ciência em Portugal. IV - A revista *Brotéria - Ciências Naturais* e a sua recepção nacional e internacional", *Brotéria*, 174, 2012, 323-33; Miguel Mota, "A contribuição da *Brotéria* para o desenvolvimento da Genética", in Hermínio Rioc S.J. & José Eduardo Franco (ed.), *Fé, Ciência, Cultura: Brotéria-100 anos*, Gradiva, Lisboa, 2003, pp. 517-527.

³¹ William Sullivan S.J. & Adam J. von Knobelsdorff, "The *in vitro* and *in vivo* effects of fluoride on succinic dehydrogenase activity", *Brotéria-Ciências Naturais*, 31, 1962, 3-13; William Sullivan S.J., "The spectrophotometric determination of malic dehydrogenase and 'malic' enzyme in normal populations of *Tetrahymena pyriformis* GL.", *Brotéria-Ciências Naturais*, 33, 1964, 143-158; Levi Guerra & F. Edmund Hunter, "Sucrose inhibition of gramicidin induced swelling of isolated rat liver mitochondria", *Brotéria-Ciências Naturais*, 34, 1965, 227-246; Elinor O'Brien & William Sullivan S.J., "Electrophoretic patterns of proteins constituents in tissues of tumor-bearing and non-tumor bearing animals", *Brotéria-Ciências Naturais*, 43, 1974, 3-14; Seikh Amjed Ali, A. Qayyun Siddiqui and A. Hasnain "Electrophoretic characteristics of soluble eye lens proteins of *Ophyccephalus punctatus* (Bloch) in different concentrations of sodium chloride solution", *Brotéria-Ciências Naturais*, 44, 1975, 9-15; Carlos Azevedo, "Nucléolo - estrutura, citoquímica e aspectos funcionais", *Brotéria-Ciências Naturais*, 48, 1978, 3-52.

³² Francisco Carvalho Guerra, "Tumefacção mitocondrial. Estudo comparativo das mitocôndrias do cérebro e do fígado", *Brotéria-Ciências Naturais*, 34, 1965, 3-226; Luís Archer S.J., "DNA-mediated transformation", *Brotéria-Ciências Naturais*, 36, 1967, 107-176; Roberto Salema, "Amido. Estudo ultrastrutural da sua biogénese em plantas superiores", *Brotéria-Ciências Naturais*, 38, 1969, 1-127.

³³ R. B. Ghosh, "Karyomorphological studies of somatic chromosomes in *Ailanthus excelsa* Roxb. - an ornamental and a road-side plant", *Brotéria-Ciências Naturais*, 39, 1970, 3-8; Syed Shafi Ashgar, D.K Khawaja & A.K. Jafri, "5'-Nucleotidase activity in the tissues of the cat-fish, *Heteropneustes fossilis* Bloch.", *Brotéria-Ciências Naturais*, 41, 1972, 3-7; S Bagchi & R.M. Datta, "On the nature of chromosome in meiotic mechanism of a natural tetraploid *Sebastiania benthamiana* Domin.", *Brotéria - Ciências Naturais*, 42, 197, 31-37; Asit Kumar Banerjee & Archana Sharma, "Chromosome studies on some indian members of Compositae. I. Tribe Inuloideae", *Brotéria-Ciências Naturais*, 43, 1974, 15-32; B.D. Chaurasia & Vijay K. Sharma, "Karyological studies in *Phaseolus mngo* Linn.", *Brotéria - Ciências Naturais* 43 (1974) 33-34; B.D. Chaurasia & Vijay K. Sharma, "Karyological studies in *Asphodelus tenuifolius* Cav.", *Brotéria Ciências Naturais*, 43, 1974, 35-37.

with his scientific agenda, following the example of Silva Tavares and Luisier, who had always combined their research with the editorial orientation of *Brotéria*. Up to 2002, *Brotéria-Genética* published more than 300 papers on bacterial genetics, plant and animal breeding, human genetics and bioethics.³⁴

Future directions

With more than 1300 original scientific articles, *Brotéria* was one of the most relevant learned journals, in Portugal, from 1902 to 2002, as I have briefly explained. Some questions, however, require further investigation and still remain to be clarified: What was *Brotéria*'s national and international projection? Was *Brotéria* similar to other publications of the Society of Jesus throughout Europe? Is it accurate to analyse *Brotéria* as a popularization journal or should we consider a different historiographical concept? How did Jesuit naturalists interact with the Portuguese scientific community and how did these interactions contributed to the development of zoology, botany, biochemistry and molecular genetics in Portugal? Was the scientific reputation of Portuguese Jesuits fully rehabilitated in the 20th century? How did the different political regimes influence the scientific and editorial activities of Portuguese Jesuits?

Acknowledgments: I would like to thank Henrique Leitão for supervising this doctoral work (supported by FCT fellowship SFRH/BD/61883/2009) and for the comments made on earlier drafts of this paper. I would also like to acknowledge Ana Simões and Ana Carneiro for their valuable comments that greatly improved this paper.

³⁴ *Índices Gerais da Brotéria Científica [1902-2002]*, Brotéria Genética, Braga, 2002. http://webpages.fc.ul.pt/~fmromeiras/Broteria_/Estatisticas.html; Luís Archer was editor of *Brotéria-Ciências Naturais* from 1962 to 1979 and then founded and directed the journal *Brotéria-Genética* from 1980 to 2002. He was also the editor of the cultural journal *Brotéria-Cultura e informação* from 1972 to 1975 and from 1993 to 2000.

Agustí Nieto-Galan, *Los públicos de la ciencia. Expertos y profanos a través de la historia* (Madrid: Fundación Jorge Juan, Marcial Pons Historia, 2011), ISBN-13: 978-84-92820-49-8, 407 pp.

*By Ana Simões**

This excellent book offers a big picture of the popularization of science and technology centred on its changing audiences. Written in Spanish, this book grew out of the author's involvement in a decade long research project, the preparation of a graduate course, cycles of seminars, an international meeting, and finally the belief that history can help in understanding present problems. In this book, the author uses history of science and technology to find solutions to what he identifies as the present malaise in scientific culture, a paradoxical situation having in mind the narrow results of so many instances of communication of science and technology to broad audiences and programmes devoted to the public understanding of science.

Informed by current historiographical debates, the involvement in the theoretical framework of the international research group, Science and Technology in the European Periphery (STEP), which the author mentions *en passant*, Agustí Nieto-Galan offers an ambitious alternative to a profusion of sophisticated specialized case-studies often focussed on the 19th century British, French or Italian contexts. He relies on a variety of examples taken from different periods and contexts, including examples from peripheral contexts (restricted mostly to the Spanish and Catalanian), in order to weave a broad picture in which chapters are organized thematically, each ranging over various centuries, with special focus on the Enlightenment, 19th and 20th centuries. Chapters successively address “Printed science” (starting with the Renaissance), “Spectacular science” (centred on, but not limited to, the 18th century), “Heterodox science”, “Science in the classroom”, and “The science of technology” (revolving around, but not restricted to, the 19th century), and “Media science” (privileging the 20th century).

In all chapters, the complex relationships between amateurs and professionals, orthodox and heterodox science, the different sites in which scientific practices took/take place, the role of particular places from the perspective of their public

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dimension, as well as the frequent tensions between educating and amusing, are selected as the common elements converging into an unified account of popularization of science throughout times and places. Additionally, they open avenues for reflection about epistemologies of laypersons and non-experts, such as amateurs, patients, students, craftsmen, visitors, and consumers, and for the assessment of their contrasting features when compared with those embraced by experts.

The book's organization mirrors its main purpose, which is to suggest how to overcome the general lack of scientific culture among the average individual (deficit model), despite all insistence on public awareness of science programmes and the various popularization of science strategies deployed throughout time. This is done by posing the problem in the introductory chapter "Introduction. The scientific culture's malaise", and enrolling the reader in a fascinating travel through the author's insightful broad history of popularization, in order to define the framework for the theoretical discussion of solutions in the chapters "Democratic science" and "Conclusions".

Centred on the participatory model, the author discusses levels of public participation, and the ways in which non-experts manage to become active players in criticizing, informing and (re)defining scientific agendas. Past historiographical proposals introduced in the 1930s are reconvened by Nieto-Galan to reveal how they already disclosed means to overcome the traditional model of communication, and eventually help surmount the unfortunate deficit of scientific culture characteristic of the population at large. In the same manner in which the horizontal view of communication gives voice to forgotten actors, institutions and places, Nieto-Galan recovers past historiographical voices, with special fondness for those of Ludwik Fleck and Antonio Gramsci, in this way empowering them with the capacity to shed light on recent historiographical debates. In reflexively doing so, the author shares with the reader bits and pieces of his own trajectory as a historian of science, and cleverly reconvenes the past to understand and act on the present. The author thus contributes to reassess the relationship of history of science and Science Studies, a discussion which opposed Sheila Jasanoff (and more recently Peter Dear) to Lorraine Daston (Sheila Jasanoff, "Reconstructing the Past, constructing the Present. Can the History of Science and Science and Technology Studies live happily ever after?", *Social Studies of Science* 30 (2000), 621-31; Lorraine Daston, "Science Studies and the History of Science," *Critical Inquiry* 35 (2009), 798-813; Peter Dear, Sheila Jasanoff,

“Dismantling Boundaries in Science and Technology Studies”, *ISIS* 101 (2010), 759-774), by taking sides with those who aim at rethinking the place and audience of history of science, and simultaneously insist on finding ways to bridge the gap between history of science and Science Studies.

While this book is addressed mainly to a Spanish speaking audience, its fresh approach to a topic at the forefront of debate within and beyond the history of science community makes it unfortunate that the language barrier alienates the English-speaking community from having access to it. A translation of this book should be seriously taken into consideration. Should this translation be made, the awkward use of the author-date system of references, relegated to the notes instead of inserted in the main text, and making it very hard for the attentive reader to profit from both notes and references in a straightforward and friendly way, should be corrected.

Laurence Talairach-Vielmas ed., *Science in the Nursery: The Popularisation of Science in Britain and France, 1761-1901*. Newcastle upon Tyne: Cambridge Scholars Publishing, 2011. 315 pp. ISBN: 978-1-4438-2680-8

By Isabel Zilhão *

Science in the nursery is a collection of thirteen essays addressing the way in which science was popularized in books for children in England and France, from late eighteenth to the beginning of the twentieth century. Some of these essays were presented at the conference “The popularization of Natural History in Britain and France in the nineteenth century”, organized by Laurence Talairach-Vielmas at the Toulouse Natural History Museum, in 2009.

As James Secord emphasises in the first article, “children’s books deserve an important place in the history of science” because, when “carefully interpreted, they provide invaluable indicators of the changing social, religious, and moral values carried by scientific knowledge in different circumstances” (p. 35). In fact, most of the authors generally recognize that, while educative and entertaining, science popularization books for children were used as a moralizing vehicle for instilling obedience and reverence to authority and to reconcile Christianity with science and the natural world. For example, Alain Rauch discusses how the reverence that the young naturalist experienced in observing nature served both the need to humbly respect authority and to reinforce God as the mighty producer of such wonders. The trained eye necessary to understand and guide vision and observation, the by-product of a growing body of knowledge, was narrowed to seeing the works of God and was thus appropriated by theology. By the same token, the essay by Laurence Talairach-Vielmas shows the urge to explain evolution and the struggle for life within the boundaries of Christian morality.

Many of the authors discuss the way popularization texts were used to support social hierarchy and racism. For example, Nicola Gould shows how diagrams and pictures were used for displaying evolution in accordance with social constructions of the time and Fanny Robles shows how Verne explored the late-Victorian fabricated idea of the missing link between humans of higher and lower races in order to question the very nature of the human race.

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Another recurrent feature of these essays is the recognition that popularisers of science appropriated literary techniques used in children's stories, in particular fairy tales, for building their narratives. Fairy tales could be paralleled to the fantastic world of science because the imagination used in such stories was the same needed to understand natural history. Moreover, fairy tales helped opening up children's minds and prepare them to understand and absorb the highly abstract and imaginative concepts often found in science, like metamorphosis and space-time dimensions that can be found in some late nineteenth-century authors (essay by Françoise Besson). Poetry and miniaturization are other discursive techniques employed by popularisers and addressed in the essays of Hugues Marchal and Muriel Louapre, respectively. But popularization of science, we learn, was also used for practical purposes as, for instance, in successfully changing children's attitude towards animals (essay by Frederick Hamilton), or in conveying the idea that scientific knowledge was necessary for a young man to reach manhood (essay by Helen Reddick).

Surprisingly, Maelle Levacher focus on how the name of Buffon was used as a decoy to sell books while his ideas were not being dealt with at all and Collete Lelay shows that in two hundred years only a small amount of books were written with the specific aim of popularising astronomy for young children in France.

While an invaluable interdisciplinary approach (History of Science, French and English literature, Sociology and Cultural studies), this book is a much in need reflection upon the way science was popularized in England and France. By combining papers from both countries, the collection is a first step to build up a comparative approach. Although the question of locality is not deeply explored, Richard Somerset's essay is an attempt to sketch resemblances and differences between the two countries. Somerset compares the way fantasy was used by Arabella Buckley as a literary technique for popularizing evolution while was regarded as something to be avoided by the anti-evolutionist Louis Figuier. Imagination, however, if used correctly, was a valuable resource for both. Actually, differences between the two countries become much more apparent in the way researchers from both sides of the Channel address the topic of popularization. Papers from English-speaking researchers deal predominantly with a narrow group of books and their authors and in the way they specifically popularize science. On the other hand, essays by French researchers are mainly focused on one theme encompassing several books and in drawing generalizations.

This book is an excellent starter for opening doors and building bridges. Are the patterns of popularization unravelled in these essays also present in other countries? Are scientific topics more up-to-date in school manuals or in science popularization books? Besides books, what other instances for popularization of science for children existed during the period under consideration? How often were newspapers used to popularize science for children? What topics were addressed in newspapers? Besides the obvious differences, how differently was science addressed and popularized in books for children and adults? Do they address the same scientific topics? Do they follow the same literary trends? As an audience, how do children react to science popularization books? What do we know about children's reception of such books? In public libraries, what are the preferred scientific topics and literary styles in science popularization books borrowed by children? Popularization of science for children is indeed a topic worth debating in the historiography of science popularization.

Timothy Mitchell, *Carbon Democracy: Political Power in the Age of Oil*. London: Verso, 2011. 278 pp. ISBN: 978-1-84467-745-0

By Lino Camprubí *

In *Carbon Democracy*, Timothy Mitchell takes the topics of his previous researches one or two steps further, to the core of global civilization. There, he finds oil fuelling capitalist democracies, labour and international relations, Islamic schools, and economic calculations, among many other socio-technical systems. Mitchell's ambitious quest of bringing the material world – fossil fuels – to the forefront of the historical and anthropological analysis of world politics in the last two centuries does not stem from reductionist materialism. Mitchell is well aware that a complex network of socio-political alliances (and confrontations) is required for the oil to flow above ground, be transported in transatlantic voyages, and be transformed into the kinds of goods we depend on.

The argument, presented in a roughly chronological order, starts at English coal mines, the place of birth of the first mass “welfare democracy” movements in Europe. Enlightened pleas for democratization were purely oligarchical until coal and railway workers were empowered by their control of “mandatory points of passage” for coal to flow. They were capable of stopping the entire system that kept the new industrial factories transforming the organic materials coming from colonized territories.

By the first third of the 20th century, oil emerged as a way of countering the immense combined power of miners, railway men, and dockers: it could be extracted and transported without their participation. Oil companies were key players in promoting the transition from coal to oil in Europe and the US. The Middle East was a key spot for their historical development. Along the 20th century, it was there where they maintained and transformed political empires (first British, later American) and produced a system of scarcity.

The first of these endeavours, building up political empires in the Middle East, is described through a history of the idea of self-determination structured around the material practices that allowed it to become a tool for imperial powers to obtain the “consent of the governed”, that is, the power of ruling through agreements

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with local elites and of intervening directly with the justification of protecting minorities. Oil was both the reason and the means for maintaining this cheap form of imperial rule.

The second venture of the oil companies, producing scarcity through “sabotage”, is a major topic running throughout the book. Historians of technology and of industrial production often take for granted that increasing the output is an in-built goal of most productive innovations and systems — this is especially so when they describe capitalism. Mitchell, following Thorstein Veblen and others, shows that for most of the 20th century the main goal of oil companies in the Middle East was delaying production through acquiring rights to prospection, extraction, and distribution, which they had no intention to use.

Other means of maintaining scarcity included promoting instability and war. This was especially evident after World War II with what Mitchell considers the construction of a Cold War designed to justify intervention in the Middle East. Violence, moreover, became a machine for exporting American weapons and thus getting revenues back from oil producer countries once the latter had seized control of the oil, in the 1960s and 1970s. This was essential to maintain the Bretton Wood system and the dollar’s strength as the international exchange currency. Since oil became the largest commodity in global exchange, controlling wells, refineries and pipelines was essential for winning the battle for the international monetary system.

This new world economy depended on oil for its very formulation. The combined systems of empire and scarcity allowed for the birth of “the economy” (Chapter 5) as a new object and field of study. Unlike 19th-century political economy, Keynesian economics were not about organizing a political society. Rather, the focus was in maintaining a system of macro-economic magnitudes of which reference to material resources had been subtracted. “National economies”, the new units of analysis, were understood as frames for the flow of money and thus abstracted from geopolitical and resource components. The “cornucopian” view of nature as an infinite source for unlimited growth was also based on cheap oil.

The fragile equilibrium of the world politics of oil revealed itself in two ways. First, resource economics returned to the scene when evidence that a peak in the oil rate of extraction became too strong to ignore. “The market” and “the environment” then emerged as the two new entities charged with optimizing the world resources of the new “energy system.” Second, US oil companies were drawn to rely on the forces

of political and fundamentalist Islamism, thus helping to construct an unstable and contradictory world of “McJihad”.

In his conclusion, Mitchell suggests that the end of cheap oil opens up the door for new political orders, including new forms of democracy. Relying on the views on socio-technical democracies put forward by authors like Michel Callon or Bruno Latour, the argument here has the dangers of assuming a “we” ready to act as a political subject with a unified interest in egalitarian claims. But where is that political subject to be found? The political debates here are fierce and Mitchell’s account is not the only one available. But it does have the virtue of reminding us that any political project needs to bring together the social, the technical, and the natural. This overview of *Carbon Democracy* does not attempt to do justice to the immensely vast array of materials and secondary literature mobilized by Timothy Mitchell to build his provocative argument. As it is to be expected from such an ambitious work, specialists of different fields will perhaps be left unsatisfied by Mitchell’s treatment of a particular topic or another. But the attractiveness and strength of Mitchell’s argument lies in its wide scope, as it proves necessary to give rise to his insightful interpretations.

Guidelines for authors

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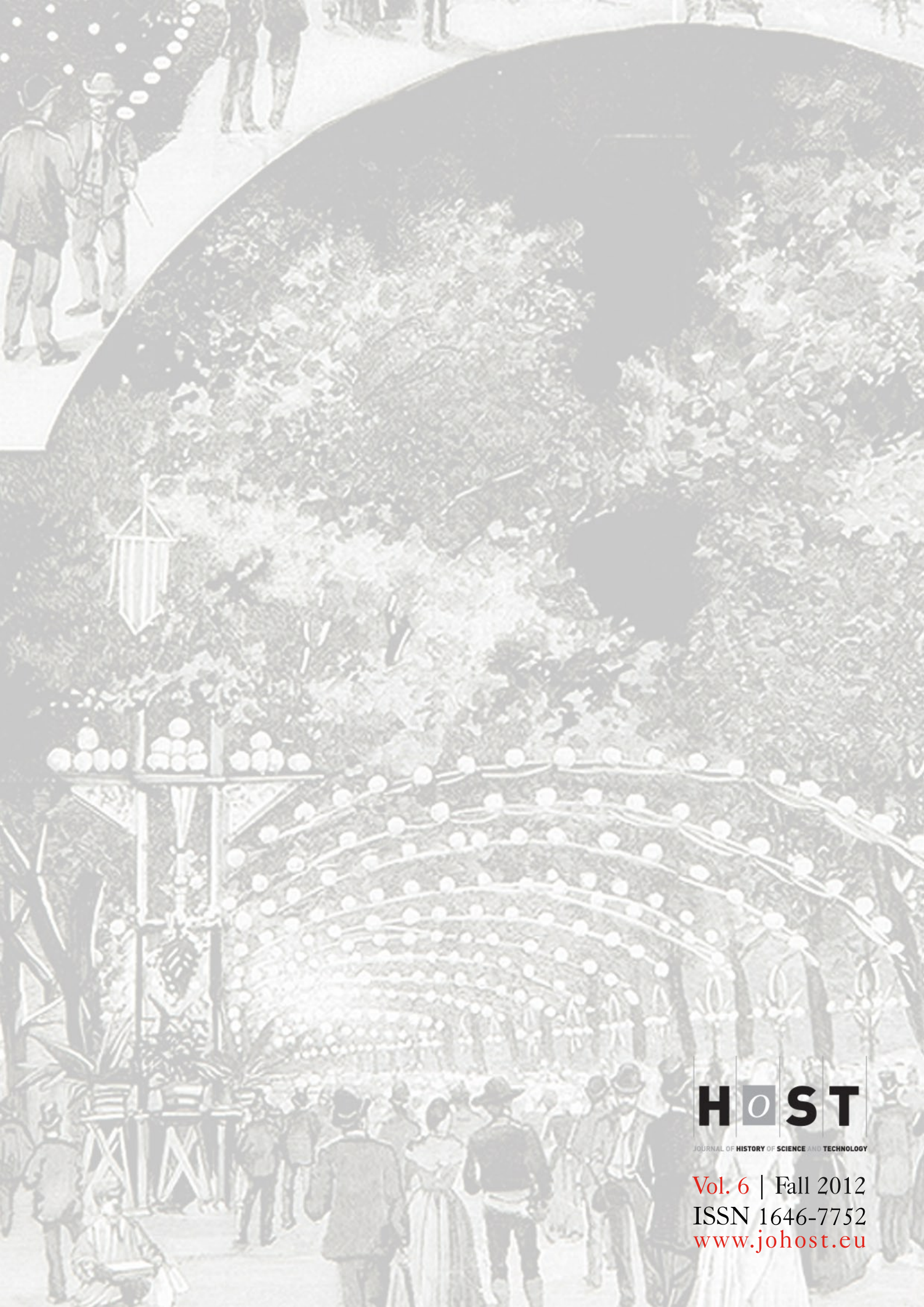
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