

# The History of Science in Latin America in its own terms

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## *Abstract*

This article conducts a comparative analysis of two journals: Quipu, created in 1984 by the Latin American Society for the History of Sciences and Technology in Mexico, published until 1994 and shortly relived between 1999 and 2000, and the Brazilian History of Science Journal, published since 1985 by the Brazilian Society for the History of Science.

Both journals initiated in a period of major historiographical change. They gave shape to a set of historical arguments about the qualities and specificities of Latin American techniques and technologies and both contributed to the structuring of an epistemic community in the field.

**Keywords:** historiography; Latin America; academic journals; history of science; history of technology.

## *Resumo*

Este artigo realiza análise comparativa de dois periódicos: Quipu, criada em 1984 pela Sociedade Latino-Americana de História das Ciências e Tecnologia do México, publicada até 1994 e brevemente retomada entre 1999 e 2000, e a Revista Brasileira de História da Ciência, publicada desde 1985 pela Sociedade Brasileira de História da Ciência. As duas revistas iniciaram um período de grandes mudanças historiográficas. Os dois periódicos deram forma a um conjunto de argumentos históricos sobre as qualidades e especificidades das ciências, técnicas e tecnologias latino-americanas e ambos contribuíram para a estruturação de uma comunidade epistêmica na área.

**Palavras-chave:** historiografia; América Latina; periódicos acadêmicos; história da ciência; história da tecnologia.

## Introduction

The purpose of this paper is to understand the Latin American historiography about science and technologies in its own terms, i.e., how this historiography reflected about its own practices. What are these terms? How were they set up? How can one possibly propose new analytical frameworks to explain these societies?

In the 1980s, studies in the history of science and technology in Latin America significantly changed by acquaintance with new approaches and perspectives in the international scenario. To understand this process of change it is vital to examine the internal organization of Latin American historiography. To this purpose I shall analyze two Latin American journals: the *Revista Latinoamericana de Historia de las Ciencias y la Tecnología - Quipu* and the *Revista Brasileira de História das Ciências - RBHC*.<sup>1</sup>

Quipu was created in 1984 and initially circulated up until 1994.<sup>2</sup> Quipu was created by the *Sociedad Latinoamericana de Historia de las Ciencias y la Tecnología*, founded in 1982, and published contributions by authors from different national backgrounds. I have selected 206 articles from that period into account here.

RBHC is still in circulation, with articles mainly written by Brazilian authors. The RBHC was created by the *Sociedade Brasileira de História das Ciências e da Tecnologia*, founded in 1983.<sup>3</sup> I have selected 76 articles published until 1994.

The criterion for selecting the abovementioned articles was their relevance for the discussion of historiographical change in studies of science and technology. It should be clear that it is not the purpose of this text to present a comprehensive account of all that was published in these journals but rather

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<sup>1</sup> Márcia Regina Barros da Silva, “História e historiografia das ciências latino-americanas: Revista Quipu (1984-2000)”, *Revista Brasileira de História da Ciência*, v. 7 (2014), p. 47-57; Márcia Regina Barros da Silva, “A escrita da História das Ciências na América Latina e seus debates”, *Hib: Revista de História Iberoamericana*, v. 9 (2016), p. 67-89.

<sup>2</sup> Quipu was interrupted in 1994 and then it went back to print in 1999 and 2000 and after a new interruption it was relaunched as an electronic journal in 2012. See <http://www.revistaquipu.com/>

<sup>3</sup> The Brazilian journal initially circulated under the name *Revista da Sociedade Brasileira de História da Ciência* and for some time coexisted alongside with the society's Bulletin, with significant overlap of authors and topics. The journal's circulation was frequently disrupted in its initial years. It was printed in 1984 and 1985, then only in 1989 and then from 1991 to 1998. It came back to print in 2003 and has since then continued up to the present. In 2008 it changed its name to *Revista Brasileira de História da Ciência*, as it is currently known, which has led us to adopt the later title in the context of this article. See (<http://www.sbhc.org.br/revistahistoria>, consulted on 2020.05.22).

to identify patterns – both hegemonic and critical, or divergent, but always patterns that are not idiosyncratic and therefore reveal shared practices. I have chosen to pay particular attention to the issue of the universality of science as opposed to the invisibility of local practices and subjects.

I discuss the Latin American historiography from that period by analyzing Quipu and RBHC as primary sources, whose importance is revealed by how many researchers, coming from different countries and from different specialty fields, published their works in them. This diversity means that such articles are a meaningful stock of texts that provide promising material for debating the local understanding of the history of Latin American science.

The journals' editors and authors, as well as their students, were mostly active in some of the most prestigious Latin American universities. Many of them held administrative positions or acted prominently in professional associations. This means that the journals brought together a diverse group of people that is quite representative of the region's mainstream teaching and research institutions. Quipu and the RBHC therefore enjoyed relative professional and institutional stability. The authors were eager to discuss the professionalization of the field and actually debated bibliographical and methodological contributions from the researchers' own countries. They also discussed syllabuses that were expected to further promote the development of specialists in this area.

In order to keep the discussion within the limits of the local appropriations of the knowledge production in the continent, I have selected only Latin American authors. It is noteworthy that approximately 15% of articles published in these journals are from non-Latin American authors homed at metropolitan centers. Significant influence of the international debate in the area of studies of science and technology, as well as the influence of international development agencies, and centers of foreign studies are noticeable. Some disciplinary areas, such as health sciences and physics, have been more influenced by the scientific traditions of metropolitan countries. The theme of international agency action cannot be overlooked when discussing the deployment and expansion of science in different Latin American regions. Nevertheless, the topic was not explicitly referenced in the articles published in the journals under discussion.<sup>4</sup>

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<sup>4</sup> On philanthropic foundations and their role in Latin America see among others Carlos Fernando Quesada, *La universidad desconocida: el convenio Universidad de Chile, Universidad de California y la Fundación Ford*, Mendoza, Facultad de Filosofía y Letras de la Universidad Nacional de Cuyo, 2015; Marcos Cueto (ed.), *Missionaries of science. The Rockefeller Foundation and Latin America*, Bloomington and Indianapolis, Indiana University Press, 1994; Marcos Cueto, "The Rockefeller Foundation's Medical Policy and Scientific Research in Latin America: The Case of Physiology", *Social Studies of Science*, 20, 2 (1990), p. 229-254.

Analyzes of the history of science and technology in Latin America and its transformations have been increasingly focused, although the two journals have not yet been duly evaluated.<sup>5</sup> The study presented here indicates at least one innovative aspect: that the authors of Quipu and RBHC sought to achieve their objectives by making the journals the field of a demarcation in search of a common positioning. The attempt was to undertake the conceptual renewal of these themes, based on analyzes that fled traditional historical studies.

My main argument is that the importance of new historical studies the attempt to overcome the invisibility of scientific practice developed on Latin American soil and specially to shed light on earlier scientific activity developed in the different Latin American nations. Some authors who participated in this renewal have recently suggested development in similar understanding but have not evaluated the same documentation.<sup>6</sup>

In an article published in 2000<sup>7</sup> the longtime editor of Quipu, Juan José Saldaña, noted how historiographical change in the turn of the 1980s was vital for the history of Latin American science. Other authors have expressed similar assessments, drawing attention to the relevance of “secret” sciences, as Mexican historian Elías Trabulse<sup>8</sup> and of “untold” science, as Peruvian researcher Marcos Cueto.<sup>9</sup>

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<sup>5</sup> Maria Amélia M. Dantes, “Integrando o Brasil à América Latina: um movimento da historiografia dos anos 1980” in Ana Maria Ribeiro de Andrade (ed.), *Caminho para as estrelas. Reflexões em um museu*, Rio de Janeiro, MAST, 2007, p. 112-125; Maria Amélia M. Dantes, “As instituições científicas na historiografia das ciências no Brasil” in Alda Heizer and Antonio Augusto P. Videira (ed.), *Ciência, Civilização e Império nos Trópicos*, Rio de Janeiro, Ed. Access, 2001, p. 225-234; Hernán Thomas, “Los estudios sociales de la tecnología en América Latina”, *Iconos, Revista de Ciencias Sociales*, 37, (2010), p. 35-53; Hebe M. C. Vessuri, “The Social Study of Science in Latin America”, *Social Studies of Science* 17, 3 (1987), p. 519-554.

<sup>6</sup> Silvia F. M. Figuerôa (ed.), *Um olhar sobre o passado: história das ciências na América Latina*, Campinas/São Paulo, Editora da Unicamp; São Paulo, Imprensa Oficial, 2000.

<sup>7</sup> Juan José Saldaña, “Ciência e identidade cultural: história da ciência na América Latina” in Silvia F. M. Figuerôa (ed.), *Um olhar sobre o passado: história das ciências na América Latina*, Campinas/São Paulo: Editora da Unicamp; São Paulo, Imprensa Oficial, 2000, p. 11-31. In the same book the subject was also approached by Emílio Quevedo, “Os estudos histórico-sociais sobre as ciências e a tecnologia na América Latina e na Colômbia: avaliação e perspectivas” in Silvia Figuerôa, *Um olhar...*, cit., p. 33-95.

<sup>8</sup> Elías Trabulse, “Latinoamericana y la ciencia: Un problema de la identidad”, *Revista Latinoamericana de Historia de las Ciencias y la Tecnología – Quipu*, 2, 3 (1985), p. 443-452.

<sup>9</sup> Marcos Cueto, “Nacionalismo y ciencias médicas: los inicios de la investigación biomédica en el Perú: 1900-1950”, *Revista Latinoamericana de Historia de las Ciencias y la Tecnología – Quipu*, 4, 3 (1987), p. 327-355. About the theme, by the same author see also Marcos Cueto, “Science under adversity: Latin American medical research and American private philanthropy, 1920-1960”, *Minerva*, 35 (1997), p. 233-245; and Marcos Cueto, “Laboratory styles in Argentine physiology”, *ISIS*, 85 (1994), p. 228-246.

Such assessments further suggest that the very beginnings of renewal can be set in the 1950s. Studies then began to associate more closely scientific activity and meaningful aspects of social life. However, they still reached very limited conclusions and typically understood that scientific activities in Latin America, before the mid-twentieth century were neither consequent nor continuous, but slight and haphazard. Such features were deemed necessary to the development of mature and independent sciences by the historians of the period. Later criticism has shown that the works produced in the 1950s were overly laudatory and especially concerned with the establishment of chronologies and celebratory reports, with the fundamental purpose of tracing the “contributions” of Latin American science to universal science.

In the understanding of the two journals we shall be discussing in this paper, the postwar historiography had a very limited methodological understanding as to how scientific activity works as well as extremely restricted knowledge of the specificities of scientific practices in Latin American countries. More recent analyses have drawn similar conclusions.<sup>10</sup> The following are usually pointed out as the most prominent authors of that period: José Babini, José Lopez Sanches, Fernando de Azevedo and Eli Gortari.<sup>11</sup>

In defense of the postwar authors it can be said that they initiated a closer reading of national science and then fostered a line of work in which science was more closely related to society, something that was avowedly inspired, not without original theoretical and conceptual contributions, by authors such as Max Weber, Émile Durkheim, as well as J. D. Bernal and Alexandre Koyré.

Here a small parenthesis is worth. In some cases, European and North American authors had close relationships with the Latin American community. Important examples are the American Thomas F. Glick and Roy MacLeod, the Spanish José Sala Catalá and Antonio Lafuente, together with their respective fellows and research groups, such as those in the Consejo Superior de

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<sup>10</sup> Antonio Arellano Hernández and Pablo Kreimer (ed.), *Estudios de la ciencia y la tecnología desde América Latina*, Bogotá, Siglo del Hombre Editores, 2011; Maria Amélia M. Dantes, “As ciências na história brasileira”, *Ciência e Cultura*, 57, 1 (2005), p. 26-29; Pablo Kreimer and Hernán Thomas (ed.), *Producción y uso social de conocimientos. Estudios de la ciencia y la tecnología en América Latina*, Bernal, Universidade Nacional de Quilmes, 2004; Moema de Rezende Vergara, “Ciência e modernidade no Brasil: a constituição de duas vertentes historiográficas da ciência no século XX”, *Revista da SBHC*, 2, 1, Jan-jun (2004), p. 22-31.

<sup>11</sup> José Babini, *Las ciencias en la historia de la cultura argentina*, Buenos Aires, Fondo de Cultura Económica, 1951; José Lopez Sanches, *Tomás Romay y el origen de la ciencia en Cuba*, Cuba, Ed. Libr; Selecta La Habana, 1950; Fernando de Azevedo, *História das ciências no Brasil*, Rio de Janeiro, Edições Melhoramentos, 2 vols., 1955; Eli Gortari, *La ciencia en la historia del México*, México-Buenos Aires, Fondo de Cultura Económica, 1963.

Investigaciones Científicas (CSIC). A demonstration of the extent of the debates that occurred simultaneously to the publication of the two journals was the “Congreso Internacional: Ciência, Descubrimiento y Mundo Colonial”, held in 1993 in Madrid, of which the published proceedings had “Mundialización de la Ciência y National Culture” as title. In its introduction, the organizers evaluated the situation of historiographical production considering the perspective of the encounter between the new and the old world and the formation of national scientific communities:

For its part, the history of science either in Latin America or in Spain has been developed based on its ability to explain the causes of the technological backwardness and the institutional rickets of the national science; the publications have been written in a political key and only very slowly became of interest to the group of historians in general.<sup>12</sup>

Between the 1960s and 1980s new groups played a relevant role in distinguishing between two kinds of historiography. One related to the history of science and technology, and another, a new historiography that had in view an approach more directed to the sociology of science. At that time, debates between the internalist and the externalist approaches gave rise to concerns about the region’s scientific policies and the role of science and technology in regional developments.<sup>13</sup>

## References

The renewal of Sciences Studies in the 1970s and 1980s brought into question the historical landmarks of what had been thought to be the origins of modern science.<sup>14</sup> Despite the professed desire to change the “image of science”<sup>15</sup>, as

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<sup>12</sup> A. Lafuente; A. Elena; M. L. Ortega (Ed), *Mundialización de la ciencia y cultura nacional. Actas del Congreso Internacional <Ciência, descubrimiento y mundo colônia>*, Madri, Doce Calles, 1993, p. 16.

<sup>13</sup> For a panel on the subject there is a huge set of works. See at least two distinguished authors: Oscar Varsavsky, *Ciencia, política y cientificismo*, Buenos Aires, Centro Editor de América Latina, 1969 and Jorge Sábato, *El pensamiento latinoamericano en la problemática Ciencia-Tecnología-Desarrollo-Dependencia*, Paidós, Buenos Aires, 1975.

<sup>14</sup> See Pamela H. Smith, “Science on the Move: Recent Trends in the History of Early Modern Science”, *Renaissance Quarterly*, 62, 2, Summer (2009), p. 345-375.

<sup>15</sup> Thomas Kuhn, *The Structure of Scientific Revolutions*, Chicago, University of Chicago Press, Third Edition, 1969 (First Edition, 1962, Postscript).

voiced by Thomas Kuhn, neither he nor subsequent authors connected with this intellectual movement actually discussed the encounter with the New World and its impact on the understanding of science and technology.

Steven Shapin attempt to reframe the notion of “Scientific Revolution” as the central idea that defines the origins of modern science. In a short footnote, Shapin noted “... that European experience of the New World was highly mediated through the long-standing textual traditions that generated expectations of what such a world might be like”.<sup>16</sup>

This remark could suggest that, from then on, the New World would finally be approached in its own terms, but what comes next does not bear out the expectations. Only three other passages in the book make reference to the New World(s), the same ones that are usually associated with lands discovered in the early sixteenth century and which continue to be referred until today “plants, animals, and minerals” all of them unfortunately from a decisively European perspective.

Although The Scientific Revolution indicates a defense of new narratives of modern science and although Shapin, truly contributed to the renewal of science studies, as many authors rightly acknowledge<sup>17</sup>, it is clear, as far as the New World, or the Latin America, excluding North America, is concerned, that the promises the book contain do not promote careful consideration and understanding of this part of the world. It thus seems that the constructivist viewpoint about the birth of modern science is itself only local, even if it is based on wider considerations than those of earlier studies.<sup>18</sup>

My criticism is intended to show that there is a conflict between the perception of localism and the actual questioning of a science’s products, even if one starts from the premise that science is not universal. The impact of Thomas Kuhn and then of the Science Studies managed to shift the focus of investigation from the domain of ideas to that of concrete communities,

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<sup>16</sup> Steve Shapin, *The Scientific Revolution*, Chicago, The University of Chicago Press, 1996, p. 19.

<sup>17</sup> Steve Shapin and Simon Shaffer, *El Leviathan y la bomba de vacío. Hobbes, Boyle y la vida experimental*, Bernal, Editora de la Universidad Nacional de Quilmes, 2005 (First Edition, 1985, in English).

<sup>18</sup> See references to the encounter with the New World and its relation to the Renaissance imaginary, amply quoting from Luis Felipe Barreto, Joan Huizinga, Lucien Febvre, Jules Michelet, Jacob Buckhardt José Sebastião da Silva Dias, Rupert Hall, Edmundo O’Gorman, Joaquim Barradas de Carvalho, Vitorino Magalhães Godinho, see Luiz Carlos Soares, *Do novo mundo ao universo heliocêntrico*, São Paulo, Editora Hucitec, 1995.



its standards and its laboratories. It did not however manage to produce a correspondent geographical.<sup>19</sup>

Kapil Raj, who is interested in the circulation of knowledge, especially the cultural encounter of Asia and Europe at the dawn of modern science, has pointed to the same disregard for geographical coordinates: “Indeed, the history of science in its classic positivist-idealist mode hardly ever asked the ‘Where?’ question of the practice of science.”<sup>20</sup>

Two exceptions are: an extensive work by Joseph Needham<sup>21</sup> and a short text by George Basalla.<sup>22</sup> Both converged in adopting the externalist viewpoint. The major importance of these authors’ works lies, however, in their drawing attention to regions outside of the circuit of modern European science. Native Latin American historiography was prominently concerned both with questioning the universality of science and its effects on techniques and technologies and with the debate on how science is transmitted.

The old question that Basalla had also asked – “How did modern science diffuse from Western Europe and find its place in the rest of the world?”<sup>23</sup> – was being rephrased. Xavier Polanco<sup>24</sup>, a prominent author in Latin American studies in those years, was widely quoted in Quipu, especially in two articles that dealt with science seen from a national point of view, foreshadowing the discussion of world science. In the first volume of Quipu itself, Polanco discussed the

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<sup>19</sup> The same could be said about the absence of Portugal and Spain in the literature about the birth of modern science. See Antonio Sánchez Martínez, “La “Atlantización” de la ciencia ibérica: el mundo atlántico visto desde la historia de la temprana ciencia moderna”, *Anuario de Estudios Atlánticos*, 60, enero-diciembre (2014), p. 29-66.

<sup>20</sup> Kapil Raj, “Beyond Postcolonialism ... and Postpositivism: Circulation and the Global History of Science”, *Isis*, 104, 2, June (2013), p. 337.

<sup>21</sup> Joseph Needham, “The Roles of Europe and China in the Evolution of Oecumenical Science” in *Clerks and Craftsmen in China and the West*, Cambridge, Cambridge Univ. Press, 1970, p. 397. See also Joseph Needham, *Science and Civilisation in China*, Cambridge, Cambridge Univ. Press, 7 vol, p. 1954-2005.

<sup>22</sup> George Basalla, “The spread of Western Science. A three-stage model describes the introduction of modern science into any non-European nation”, *Science*, 156 (1967), p. 611-622.

<sup>23</sup> George Basalla, “The spread...”, cit., p. 611.

<sup>24</sup> Xavier Polanco, “Une Science-Monde: La mondialization de la science européenne et la creation de tradition scientifiques” in Xavier Polanco (ed.), *Naissance et développement de la science-monde production et reproduction des communautés scientifiques en Europe et en Amérique Latine*, Paris, Ed. La Découverte, Conseil de l’Europe, UNESCO, 1990. In the same book: Bruno Latour and Xavier Polanco, “Quelques remarques à propos de l’histoire des sciences. Le modèle de la rosace”. See also Xavier Polanco, “World-Science: How is the history of world-science to be written?” in Patrick Petitjean, Cathérine Jami, Anne Marie Moulin (ed), *Science and Empires: Historical Studies about scientific development and european expansion*, Dordrecht, Kluwer Academic Publishers, 1992.



“inner brain drain” – meaning the phenomenon of local researchers concerned with foreign geographical coordinates. In another publication, the next year, he discussed the idea of a contextualized epistemology.<sup>25</sup>

The issue of the geographical coordinates of scientific practice is still central in the Latin American debate.<sup>26</sup> It is equally important to think about the production carried out in Latin American soil as well as local problems and interpretations. David N. Livingstone, for example, discusses the so-called “placeless place”<sup>27</sup> focusing on laboratories built for scientific purposes anywhere on the globe. He is especially concerned with the (dis)placements of a model of science that originated in Europe. I agree with Livingstone as he puts forth the argument that science produced in different portions of the globe result in different understandings and draw on different resources from diverse cultures and groups. Here, my intention is however to ascertain the effort to create a proper explanation of the specifically Latin American conditions of realization of the sciences in no-European soil. The objective is to verify how in the two journals the following discussions were undertaken: what are the conditions that make sciences and technologies specific to Latin America? How do they produce specific knowledge in spite of all the above mentioned compromises of both academics and politicians in the hope of technical and scientific, material and economic progress?

## The journals

Quipu was launched as an editorial novelty directed to themes of interest in Latin American research on the history of science and technology (Table 1).<sup>28</sup> These range not only from areas with more or less production of studies,

<sup>25</sup> Xavier Polanco, “Science in the developing countries. An epistemological approach on the theory of science in context”, *Revista Latinoamericana de Historia de las Ciencias y la Tecnología – Quipu*, 2, 2, mayo-agosto (1985), p. 303-318. Xavier Polanco, “La ciencia como ficción. Historia y contexto” in *Cuadernos de Quipu 1. El perfil de la ciencia en América. Sociedad Latinoamericana de Historia de las Ciencias y la Tecnología* (1986), p. 41-56.

<sup>26</sup> A well-known exception is Mary Louise Pratt, *Imperial Eyes. Travel writing and Transculturation*, London, Routledge, 1992. For a recent overview of the Latin American output, see Eden Medina, Ivan da Costa Marques and Christina Holmes (ed.), *Beyond Imported Magic. Essays on Science, Technology, and Society in Latin America*, Cambridge, The MIT Press, 2014.

<sup>27</sup> David N. Livingstone, *Putting science in its place. Geographies of Scientific Knowledge*, Chicago, The University of Chicago Press, 2003.

<sup>28</sup> Difficulties in the journal’s circulation were only to be expected given the sheer dimensions of the continent, but also due to economic instability, difficulties in the communication etc.

such as medicine and physics, but also from countries with relatively strong traditions in the production of historical studies on science and technology to countries with little development in this field. This can be seen in the different volume of production per country and in the concentration of themes developed, notably in articles on the history of medicine and on mining technologies. The immediate readership comprised the researchers of those countries themselves, as stated by Henrique Beltran in the first article of the journal: “We usually are better informed of what happens in the Anglo-Saxon portion of the continent than of what happens in the sister Republics of the hemisphere, despite our shared origins, language and habits”.<sup>29</sup>

Table 1. Articles per country in Quipu (1984-1994)

Total	Mexico	Brazil	Colombia	Argentina	Venezuela	Spain	USA	Chile	Cuba	Others	France	Peru	Costa Rica
207	64	38	18	15	17	16	12	6	7	6	5	5	3

Since the first issue, in both editorials and articles, the professionalization of the field and the “recognition of the scientific and technical patrimony of Latin American countries”<sup>30</sup> were treated as part of the same problem. Many articles dealt with the implementation of academic syllabuses in the history of sciences and techniques, especially in the contexts of undergraduate courses in scientific faculties and of postgraduate courses in the Human Sciences and more particularly in the faculties of History.

The second issue in the journal’s first year can be taken as an example since it dealt with the teaching of the discipline, in both elementary and specialized contexts. The issue presented syllabuses in the history of sciences in Colombia, Brazil and Mexico, and articles made suggestions as to how such syllabuses could be integrated in Mathematics, Architecture and Medicine. The purpose

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Three issues per year were foreseen, with an average of six original articles, as well as reviews and occasional columns. Most articles were written in Spanish, but also a reasonable number in Portuguese and a few in English.

<sup>29</sup> Enrique Beltran, “La historia de la Ciencia en América Latina”, *Revista Latinoamericana de Historia de las Ciencias y la Tecnología – Quipu*, 1, 1, enero-abril (1984), p. 7-23, cit. p. 7.

<sup>30</sup> Juan José Saldaña, “Presentación”, *Revista Latinoamericana de Historia de las Ciencias y la Tecnología – Quipu*, 1, 1, enero-abril (1984), p. 5.

was to find ways to “appropriate its intrinsic pedagogical value”<sup>31</sup> so as to turn the history of science “into a serious and important discipline”.<sup>32</sup> It should serve to “draw as many connections as possible”<sup>33</sup> with general history and the histories of economy and philosophy, so that “students can learn to formulate problems in the fields of these sciences and practices and also to devise the proper methodology to tackle them”.<sup>34</sup>

The journal was thus putting forward a teaching proposal with the aim of setting the foundations for what should be taught, of helping to identify and structure the academic communities and shape the future of the field. The concern with how to teach the history of science thus preceded the publication of actual historical case studies in the journal.

For some authors, professionalization in the area involved considering Latin America’s position within the framework of underdevelopment and colonialism. A researcher from the Physics Institute in the Universidad Autónoma de México/UNAM hits the point:

Furthermore, the specific role played by the development of science in our Latin American countries – conditioned by colonialism and underdevelopment and founded upon an extraordinary mixture of the traditional knowledge of our indigenous peoples and the European cultures that came with the conquest – is a pressing matter of investigation.<sup>35</sup>

For others, such as Ruy Gama, who taught at the Faculty of Architecture in the University of São Paulo, Brazil, the aim of these studies could be “an inventory of the instruments deployed by the settlers in their occupation of Portuguese America since the sixteenth century”. Or, more specifically, “the adaptations such instruments had to undergo as an effect of the specific or unforeseen circumstances faced by the settler”.<sup>36</sup> This, as a number of other

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<sup>31</sup> Luis Carlos Arboleda, “Historia y enseñanza de las matemáticas”, *Revista Latinoamericana de Historia de las Ciencias y la Tecnología – Quipu*, 1, 2, mayo-agosto (1984), p. 167.

<sup>32</sup> Tomas A. Brody, “La historia de la ciencia en la enseñanza”, *Revista Latinoamericana de Historia de las Ciencias y la Tecnología – Quipu*, 1, 2, mayo-agosto (1984), p. 195.

<sup>33</sup> Ruy Gama, “O ensino de História da Técnica na Faculdade de Arquitetura e Urbanismo da Universidade de São Paulo”, *Revista Latinoamericana de Historia de las Ciencias y la Tecnología – Quipu*, 1, 2, mayo-agosto (1984), p. 206.

<sup>34</sup> Emilio Quevedo, “Papel de la Historia de las Ciencias en la integración curricular de la Escuela Colombiana de Medicina”, *Revista Latinoamericana de Historia de las Ciencias y la Tecnología – Quipu*, 1, 2, mayo-agosto (1984), p. 223.

<sup>35</sup> Tomas Brody, *La Historia...*, cit. p. 195.

<sup>36</sup> Ruy Gama, *O ensino...*, cit., p. 213.

articles, envisaged a prominent role for the history of science, directed at “understanding the participation of the peoples that occupied this space in the development of the Western world. It also aims at a criticism of the local heritage and how it shaped the present challenges”.<sup>37</sup>

The RBHC was also concerned with the topic of teaching and devoted its third issue, published in 1989, to the papers originally presented in the Second Latin American Conference on Alternatives to the Teaching of the History of Science and Technology, held in Brazil in February 1987.<sup>38</sup> The debates focused on a discussion of the social underpinnings of science and technology as opposed to the perceived objectivity of its subject matter.

The same topic had been discussed in different talks during the conference, as for example in the inaugural lecture “The search for a future for future”, Juan José Saldaña, UNAM<sup>39</sup> and in the opening lecture “Social History and the Formation of a Scientific Culture”, Luis Carlos Arboleda, Universidad del Valle, Cali, Colombia.<sup>40</sup>

Proposals of alternative explanations for the sciences and how they work abounded in the conference’s proceedings published in the RBHC. A common thread in the very diverse contributions is the clear attention paid to local issues, focusing on particular problems of the Latin American countries. On the panel “Alternatives in the teaching of science history”, Hebe Vessuri’s paper “Social studies of sciences in Latin America” emphasized “...the need to develop a certain kind of teaching of Science History that aims at people concerned with the present and the future and not exclusively with the past”.<sup>41</sup>

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<sup>37</sup> Ruy Gama, *O ensino...*, cit., p. 213.

<sup>38</sup> The presentation of the volume was written by the president of the Sociedad Latinoamericana de Historia de la y la Tecnología, who had organized the previous conference, held in Bogota in 1985. He mentions the Primer Encuentro de la Historia de la Ciencia y la Tecnología, held in Puebla in 1982, when the Latin American society would have been founded. The SLHCT conferences took place in Havana (1985), São Paulo (1988), Mexico (1992), Cali (1994) and Rio de Janeiro (1998). A further conference, which was meant to meet in Buenos Aires, in 2002, was cancelled. There is some information at (<http://www.fcea.unr.edu.ar/VICongresoSLHCT/>, consulted on 2020.05.23). See in Alberto Saladino García has further investigated the organization of conferences: Situación de los estudios de historia de la ciencia en América Latina, available at (<http://www.ufg.edu.sv/ufg/theorethikos/octubre99/analisis2.html>, consulted on 2020.05.22).

<sup>39</sup> Juan José Saldaña, “En busca de un futuro para el futuro”, *Revista da Sociedade Brasileira de História da Ciência*, 3 (1989), p. 3-9.

<sup>40</sup> Luis Carlos Arboleda, “Historia social y formación de una cultura científica”, *Revista da Sociedade Brasileira de História da Ciência*, 3 (1989), p. 11-16.

<sup>41</sup> Hebe Vessuri, “Los estudios sociales de la ciencia en América Latina”, *Revista da Sociedade Brasileira de História da Ciência*, 3 (1989), p. 27.

On the same panel, Brazilian physicist José Maria Bassalo proposed that “including the works of Latin American physicists in the syllabus of History of Physics and related disciplines aims at publicizing their work and at stimulating Physics students to undertake academic research”.<sup>42</sup>

The debate about professionalization was not however dissociated from criticism of the way science was produced in the region and of the role played by colonialism in shaping it. One article was particularly referred to in this connection: “Colonial science and professional roles in eighteenth-century Hispanic America”. The article compares Latin American colonial scientists and their metropolitan counterparts in Spain and elaborates on the category of “colonial science” that would be taking shape in the eighteenth century. The authors saw the understanding of local practices as crucial for the development of a new history of sciences: “...to design a research strategy that regards geographic and cultural factors as fundamental criteria and a necessary starting point”.<sup>43</sup>

The article made ample use of work that supported the change of perspective and were aligned with their wider agenda: Roy Macleod, David W. Chambers, Lewis Pyenson, Xavier Polanco, among others. Elaborating on these previous publications, Lafuente and Catalá criticized the traditional history of science, especially as exemplified by George Basala and his three-phase model. Basala still was widely influential in Latin America, although increasingly criticized by then. Lafuente and Catalá also discussed authors that remain influential today, such as Bruno Latour and Edward Said. They furthermore engaged in a direct exchange with Latin American authors that had written in the 1970s and clearly marked their differences. According to them, Amílcar Herrera, Jorge Sábato, Simon Schwartzman, Eduardo Fuenzalida and Francisco Sagasti, among others, were exclusively interested in “social and economic factors”, looking at science from the perspective of an evolution in successive stages. Lafuente and Catalá point out that this approach revealed an expectation of progress, an inadequate perspective for understanding the reality of Latin American colonies in the Eighteenth century.<sup>44</sup>

Many authors began to study how science diffused in the “periphery”, a process that could not be dissociated from how science circulated (materially, ideologically, politically and culturally) in Europe. Another landmark of this

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<sup>42</sup> José Maria Filardo Bassalo, “Alternativas de ensino da física nas universidades latino-americanas”, *Revista da Sociedade Brasileira de História da Ciência*, 3 (1989), p. 30-32.

<sup>43</sup> Antonio Lafuente and José Sala Catalá, “Ciencia colonial y roles profesionales en la América Española del siglo XVIII”, *Revista Latinoamericana de Historia de las Ciencias y la Tecnología – Quipu*, 6, 3 (1989), p. 387-402.

<sup>44</sup> Lafuente and Catalá, *En busca de...*, cit., p. 393.

methodological change is Luis Carlos Arboleda's "Acerca de la difusión científica en la periferia: el caso de la física newtoniana en la Nueva Granada (1740-1820)", published in 1987.<sup>45</sup> Based on source studies and on an evaluation of previous scholarly work, especially that of Sal Restivo, Arboleda was looking for "epistemological strategies" that could shape a "sociology of objectivity". It was time for a new approach that could renew the history of sciences and technologies:

Maybe historians should learn from sociologists and anthropologists of science how to set ourselves free from that intellectual heritage and how to identify the signs given by our everyday research showing us that every form of knowledge is, in the best possible sense, a social construct deeply rooted in social interests.<sup>46</sup>

In papers published in *Quipu* and in other vehicles that fall outside of the immediate scope of this investigation, Hebe Vessuri<sup>47</sup> and Marcos Cueto<sup>48</sup> also advocated new perspectives on Latin American science by respectively putting forward the notions of "national styles" and "scientific excellence." The turn towards local specificities in the science of non-central countries became the basis for an interpretation that, if not entirely new, was at least more self-aware than ever before. These perspectives had been partly triggered by the reading of authors that were performing what is today regarded as a renewal of the sociology of science in Europe, but even more importantly by expanding their view of science as a cultural and historical practice, as opposed to a purely epistemological activity connected with models of economic development.<sup>49</sup>

Social history was a discipline, that brought new scholars together and set them against the discourse that had been in favor with the previous generations. It was a means of establishing a difference and attacking traditional premises. An example of this clash of generations can be seen in the debate following

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<sup>45</sup> Luis Carlos Arboleda, "Acerca de la difusión científica en la periferia: el caso de la física newtoniana en la Nueva Granada (1740-1820)", *Revista Latinoamericana de Historia de las Ciencias y la Tecnología – Quipu*, 4, 1 (1987), p. 7-30.

<sup>46</sup> Luis Carlos Arboleda, *Acerca de...*, cit., p. 10.

<sup>47</sup> Hebe Vessuri, "Estilos nacionales en ciencia", *Revista Latinoamericana de Historia de las Ciencias y la Tecnología – Quipu*, 11, 1 (1994), p. 103-118.

<sup>48</sup> Marcos Cueto, "Nacionalismo y ciencias médicas: Los inicios de la investigación biomédica en el Perú: 1900-1950", *Revista Latinoamericana de Historia de las Ciencias y la Tecnología – Quipu*, 4, 3 (1987), p. 327-355.

<sup>49</sup> Barry Barnes, *Scientific knowledge and Sociological Theory*, London, Routledge, 1974; Michael Mulkay, *Science and the sociology of knowledge*, Winchester, M. A, Allen & Unwin, 1979; Bruno Latour, *Science in action: How to follow scientists and engineers through society*, USA, Harvard University Press, Cambridge Mass, 1987.

the opening lecture in the conference proceedings published in the RBHC. The first reaction was to criticize what was seen as a denial of the reality of things. The sociological perspective would have introduced an overvaluation of subjectivity in the social history of sciences. This was the view expressed in the debate by Shozo Motoyama, from the University of São Paulo, Brazil, who also authored texts in Quipu:

The intentions of Professor Arboleda and of this incipient new historiography deserves the highest praise. I do however have second thoughts, so to speak, as to certain exaggerations I sometimes perceive in this brand of work. (...) This is so because it seems to look at the remote past of the Antiquity and the Middle Ages through rose-tinted spectacles, an era of prevalent subjectivity in their construct. The harsh and hideous present would have initiated in the modern age with the mounting of objectivity. Science would be the ungrateful and cold daughter of this objectivity.<sup>50</sup>

The debates show that part of the project being carried out in these journals was that of developing a local, non-European, narrative, much as European authors were read and discussed, both in agreement and dissent. The different contributions were then in one way or another taking a position regarding the new social history of science and technology. Many papers urged the development of a social history that would be a means of understanding the current state of science and thus guide one as to the best path forward. The internal/external debate was still there, but most authors agreed upon the coexistence of both factors – a key point for scientific and technological activities in Latin America to be evaluated in the past and the present and maybe even conducted in the future according to the group's agenda.

### **Professionalization: a critical overview**

There was much discussion about professionalization and academic recruitment between the 1970s and the 1990s. The editorials and articles in Quipu were from the start concerned with establishing that there was a significant number of scholars involved in studying local sciences and technologies and that they were qualified professionals. This is clear from the first issue's editorial:

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<sup>50</sup> Shozo Motoyama, "Debates", *Revista da Sociedade Brasileira de História da Ciência*, 3 (1989), p. 17.



Quipu, the Latin American Review for the History of Science and Technology, is the first editorial effort at consolidating the significant progress that is being made in Latin America: historians of science and technology have been in constant dialogue and have been working towards the professionalization of their activities.<sup>51</sup>

The presentation of the first issue of the RBHC was written by scientist José Reis<sup>52</sup>, who also noted the journal's intention to become a "vehicle for the national academic output", concerned with the professionalization of the field and intent upon contributing to the development of science itself.

Something similar was under way in Europe and in the United States. The concerns expressed in those texts have much in common with the categories that Steve Shapin and Simon Schaffer more recently identified in a discussion of alternatives for the history of sciences in Europe and the United States. Commenting on the reception of their most famous book, *Leviathan and the Air-Pump*, they note that "there were other intellectual developments in the 1970s and 1980s which were also opening up a space where alternatives to existing historiography and its categories might be conceived". The new categories would be:

(1) the professionalization of the academic history of science and related modes of inquiry; (2) developments in other academic practices engaged with the understanding of science, related forms of culture, and the cognitive practices of everyday life; and (3) changes in the institutional circumstances of the scientific enterprise itself and associated changes in how both laypeople and scientists themselves thought about the nature of science.<sup>53</sup>

An article by Thomas Kuhn that appeared in Quipu in 1986 dealt with this overall change of perspective, under the title "The histories of science: different worlds for different audiences".<sup>54</sup> The text had been written in 1985 for the inaugural lecture of the XVII International Congress of the History of

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<sup>51</sup> Juan José Saldaña, "Presentación", *Revista Latinoamericana de Historia de las Ciencias y la Tecnología – Quipu*, 1, 1 (1984), p. 5-6.

<sup>52</sup> José Reis, "Brazilian physician and scientific journalist", *Revista da Sociedade Brasileira de História da Ciência*, 1, janeiro-junho (1985), p. 3.

<sup>53</sup> Steven Shapin and Simon Schaffer, "Introduction to the 2011 edition. Up for Air: Leviathan and the Air-Pump a Generation On" in *Leviathan and the Air-Pump: Hobbes, Boyle, and the experimental life*, N. J., Princeton University Press, (2011), p. XVII.

<sup>54</sup> Thomas Kuhn, 'Las historias de la ciencia: mundos diferentes para públicos distintos', *Revista Latinoamericana de Historia de las Ciencias y la Tecnología – Quipu*, 3, 2, mayo-agosto (1986), p. 167-175.

Science, held in Berkeley. It proposed that the professionalization of science history could be identified by the growing number of specialists working in the field. The increase in the number of papers in the international conferences in the field pointed to new interests as well as to a new professional identity: 70 in Amsterdam, 1950; 220 in Ithaca, 1962; and 725 in Berkeley, 1985.

In Kuhn's view, students coming from the social sciences and their tighter relation with History departments contributed to the appearance of the new social history of science. Such an association would have resulted in changes of interpretation fostered by generations of non-scientists. For him, bringing the idea of reason into question provided new explanations for how science and technology work.

In Latin American studies, most articles were case studies of local scientists and institutions, of the reception of the work of important foreign scientists and of the introduction of services, activities and disciplines in the region. A smaller number of articles was concerned exclusively with foreign characters and situations. The RBHC, on its turn, had a more even distribution of local and foreign topics.

According to many scholars, chronicles written in the colonial era could already be regarded as history of science and technique while also retaining their nature of primary sources. Texts based on previously unpublished sources and those that offered new insights on texts that were already available all contributed towards establishing the burgeoning existence of early scientific practices in the New World and showing that they related to contemporary activities in Europe. The emphasis on primary sources seems to have been promoted as an argument to establish in a definitive way that the New World had been the scenery of relevant early scientific endeavor.

Henrique Beltrán, for instance, proposed that the writing of science history started with Don Christobal de la Plaza y Jaen's chronicle "the first historian of science in Mexico and possibly in Latin America." In Beltrán's view, the chronicle was "an extremely valuable source of information".<sup>55</sup>

The identification of local technical innovation was another concern that drew historians to the reading of primary sources. An article by Colombian engineer Armando Espinosa Baquero, for example, is devoted to the history of metalwork in Mexico and is particularly interested in the discovery of

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<sup>55</sup> Beltrán, *La historia...*, cit. p.15, he referred to "Crónica de la Real y Insigne Universidad de México de la Nueva España. En edades desde el año de 1553 hasta el de 1687". The text was written when Don Christobal de la Plaza y Jaen was secretary and lecturer in the University of México de la Nueva España.

platinum. Traditional history told that Spanish sailor Don Antonio de Ulhoa had discovered this metal in 1748. During the Expedición Geodésica Franco-Española, conducted between 1736 and 1746, he would have collected the material and then formally introduced it into Europe. In 1750, botanist and physicist William Watson would have presented the finding at the Royal Society of London, of which he was a fellow, and then, in the same year, published about it in a periodic called Philosophical Transaction.

Baquero, however, points to previously unknown documents in the Archivo Nacional de Bogotá and in the local archives of Popayán with previous identifications of platinum: "... in Nova Granada (currently Colombia), this metal was not only known, but it was also separated from gold and quantified. These operations were current practice at least ten years before the arrival of the expedition [1726]." For the author, "another point of interest is that many English authors undeservedly appear in a few published works as discoverers of platinum".<sup>56</sup>

The article concluded expressing the hope that, "in the future", new documents might be able to shed more light on the methods used for separating platinum from gold even before 1726. Besides, Baquero suggested that the debate on isonomy in studies of science and technology was long overdue:

Everything will depend on establishing whether the history of science is the history of scientific ideas or the history of how these ideas were formalized and then, if the latter is the case, one will have to indicate how to discriminate different sources from the same period and based on what criteria.<sup>57</sup>

For Baquero, the very notion of technology had to be revisited in order to harmonize the events in Latin American history with expectations about these events. Other scholars, such as Sergio Ortiz Hernan, dealt explicitly with the meaning of Latin American technology: "a cultural product, as a means of social expression, a set of instruments, mediums, skills and pieces of knowledge that define a society's character and give it meaning".<sup>58</sup>

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<sup>56</sup> Armando Espinosa Baquero, "Nuevos datos sobre el descubrimiento del platino y su metalurgia en la Nueva Granada en el siglo XVIII", *Revista Latinoamericana de Historia de las Ciencias y la Tecnología – Quipu*, 2, 1, enero-abril (1985), p. 7-21.

<sup>57</sup> Baquero, *Nuevos datos* ..., cit., p. 20. The topic of platinum was taken up in another article: Luis Fermín Capitán-Vallvey, "Las autoridades coloniales y la platina neograndina a comienzos del siglo XVIII", *Revista Latinoamericana de Historia de las Ciencias y la Tecnología – Quipu*, 5, 3, septiembre-diciembre (1988), p. 429-443.

<sup>58</sup> Sergio Hortiz Herman, "La innovación ferroviaria en el México del siglo XIX", *Revista Latinoamericana de Historia de las Ciencias y la Tecnología – Quipu*, 2, 1, septiembre-diciembre (1985), p. 64.

Investigating the history of railroads, the same scholar remarks on the many expectations surrounding them and, at the same time, the immense difficulties faced in their implementation:

In the past century, an overoptimistic attitude towards railroads, based on the belief in their capacity to bring about change, was widespread in Mexico. Almost everything was expected of them. They were the key to progress, the assured solution of all national problems of every kind: economic, social, political (...).<sup>59</sup>

In Hernán's view, however, the consequences of the struggle for independence did not meet such high expectations. The construction of the first railroads meant the demise of the old means of transportation – carriages, carriers and their mules – also affecting producers that were located close to old pathways and roads. Conversely, the technological innovation promoted the unexpected appearance of other characters, such as the producers of “pulque”, a local beverage that could now reach other regions of the country.

This transformation led to the fall in food prices as those of grain employed to feed livestock previously used for trade in localities that were not reached by railroads. The excess offer resulting from the introduction of a new means of transportation shifted the relative importance of geographical regions, leading to protests of farmers and indigenous peoples.

The destruction of railroads when by the opposition in the 1910 Revolution turned the railroad into a “character in the armed struggle”.<sup>60</sup> The history of that innovation could hardly be written outside of the framework provided by this broader history.

## **Conclusion**

Although I have not so far discussed the concepts of science, technique and technology and their mutual distinctions, I assume that the notion of technoscience can usefully refer to the system of associations and substitutions comprising technical objects, technological progress and society.<sup>61</sup>

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<sup>59</sup> Hernán, *La innovación...*, cit., p. 63.

<sup>60</sup> Hernán, *La innovación...*, cit. p. 79.

<sup>61</sup> Bruno Latour, “Technology is society made durable”, *The Sociological Review*, 38, 1 (1990), p. 103-131.

In the Latin American historiography of the 1980s and the 1990s, conceptual debates were prominent. Ruy Gama's piece "Words and words: topics for a history of technology"<sup>62</sup> discussed the etymology of 'technology' and its successive semantic transformations, from Ancient Greece down to the European eighteenth century. The author also gave a nationalistic turn to his article by proposing to identify the first man to have used the word "technology" (tecnologia) in Brazil, José Bonifácio de Andrada e Silva, in 1793, after attending classes in the Lycée des Arts in Paris. At the end of the text, Gama explicitly referred to the contradictions in the social and economic debate in Brazil:

I hope to have contributed, with this attempt at conceptual clarification, to the discussion of issues of technological transfer, nationalization of technology and 'alternative', 'soft' or 'adequate' technologies – half-sciences for the use of the impoverished – an administration of poverty.<sup>63</sup>

Ruy Gama wrote a few times in Quipu and in the RBHC. In a piece bearing the title "On the history of technique", the same excerpt reappears, this time at the beginning of the text. His was a call for Brazil to discuss development and technology in association with the importation of technology and the nature of national technology.<sup>64</sup>

The article raised many issues in an attempt to understand the technical reality of the Brazilian colony, and especially to identify the "conscience-object relations" that could explain "two fundamental political issues", the ideas of progress and of national independence.<sup>65</sup> The history of technique was presented as that of the machinery in sugar plantations (engenhos) set in motion by the slave workforce. Gama did not deny the rusticity of local technique and technology as compared with European mills, refineries and nascent factories,

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<sup>62</sup> Ruy Gama, "Palavras e palavras: temas para uma história da tecnologia", *Revista Latinoamericana de Historia de las Ciencias y la Tecnología – Quipu*, 2, 1, septiembre-diciembre (1985), p. 87-93.

<sup>63</sup> Ruy Gama, *Palavras...*, p. 92. José Bonifácio de Andrada was also studied in another issue in a piece devoted to the scientific trajectory of the Brazilian politician and mineralogist, with further reference to his attendance of courses in Paris. Maria Margaret Lopes, "José Bonifácio de Andrada e Silva – O mineralogista – na produção historiográfica brasileira", *Revista Latinoamericana de Historia de las Ciencias y la Tecnología – Quipu*, 2, 1, septiembre-diciembre (1985), p. 335-344.

<sup>64</sup> Ruy Gama, "Sobre a história da técnica", *Revista Latinoamericana de Historia de las Ciencias y la Tecnología – Quipu*, 11, 1, enero-abril (1994), p. 26.

<sup>65</sup> Gama, *Palavras...*, cit., p. 28.

as for instance the mills brought from Portugal and Spain for producing olive oil or the equipment used from Sicily to England for steam or vacuum cooking<sup>66</sup>, but he pointed out similarities between Brazilian and European texts about the technical (scientific) artifacts in the early 18<sup>th</sup> century,

His primary sources were the writings of Jesuit priest João Antonio Andreoni, known under the name of André João Antonil, who in 1711 published the book “Culture and opulence of Brazil by its drugs and mines”. According to Gama, the priest resembled the central authors of modern science, such as Giordano Bruno, by speaking of “man surpassing nature”:

Who called the factories where sugar is produced *engenhos* really found the right name. Because whoever sees them and considers them as thoughtfully as they deserve to be considered, must confess that they are one of the most ingenious inventions of the human mind, which, as a fraction of the Divine, is always admirable in its workings.<sup>67</sup>

What really mattered to him, though, was determining “what is actually ‘national’ in the Brazilian *engenhos*.” The answer was to be found not only in features of the machinery, although that also mattered, but especially in the “organic manufacture itself as a mode of organizing labor”.<sup>68</sup>

As a result of the spatial organization of sugar plantations and how the manor and the slave quarters (*senzala*), the chapel and the factory were set up, work was extremely fragmented, but, all the same, was organized “as a major automaton – a machine of human parts – in which everyone made sugar and nobody made sugar”.<sup>69</sup>

The excessive workload and the violence with which work was performed would thus be integrated with the local machinery, thus nationalizing, as one might say, the technique. This would provide a distinguishing mark in the spatially structured history of the master-slave relation.

The invisibility of Latin American sciences – viewed from the viewpoint of the three coveted modern gifts of science, technique and technology – is thus in itself a meaningful aspect of our controversial history of technique and technology.

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<sup>66</sup> Gama, *Palavras...*, cit., p. 37.

<sup>67</sup> Gama, *Palavras...*, cit., p. 31.

<sup>68</sup> Gama, *Palavras...*, cit., p. 37-38. Brazilian intellectual Darcy Ribeiro referred to the same situation in 1985 as ‘Moinho de gastar gente’ (‘Mill for grinding people’). Darcy Ribeiro, *The Brazilian People: The Formation and Meaning of Brazil*, University Press of Florida, p. 2000.

<sup>69</sup> Gama, *Palavras...*, cit., p. 38.

It would be impossible to understand technologies in Latin America by exclusively focusing on inventions and innovations that have or have not been developed in the region. It would likewise be meaningless to evaluate what has actually been produced if one does not account for all that has been destroyed in the process: objects, techniques, procedures as well as vast amounts of knowledge. In Latin America, science and technology and innovation are frequently dealt with as closely associated topics and seen as a key to solving all of the region's problems. Still today technology is as a rule thought of as infrastructure that will support development and progress.