

Writing of biographical micro-narratives of Luso-Brazilian travelers: Connections between the History of Science in Brazil and teaching

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Abstract

This study about the Philosophical Portuguese Journeys to Brazil aims at expanding the theme of and the approach to the History of Science in Brazil, promoting the debate about how the work on scientific practices, techniques and representations allows the development of teaching methodologies that encompass Brazilian themes in their context. From the gathered sources, obtained from a bibliographical database of travelers, we were able to draw relationship webs linking politicians, drawers, engineers, cartographers, engravers, naturalists and the local population. In order to disclose the data, this gathered material challenged us to think about proposals of biographical writings of travelers within the virtual environment. Such framework allows our work to ensure two scales of importance, i.e., to emphasize the particular role of travelers, demonstrating singularities, and to guarantee the analysis of social contexts via interpersonal relations from a space-time perspective. Within such biographies and elaborating on the hybrid character of the genre, we defined that the formulation of micro-narratives would grant the biographical writing constructed around the travelers. The writing of short texts will basically follow the modal biography, pointing to the network of social relations of the subject, and also by the biographemes, characterized by the production of a momentary biographical impression. Through a non-linear historical process, the biographical writings and the creation of hyperlinks allow the complex nature of the relationships of that period to be reflected in the micro-narratives formulated.

Keywords

Biographical writings – Teaching of sciences – Philosophical journeys – Scientific publications.

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Escrita de micronarrativas biográficas de viajantes luso-brasileiros: aproximações entre história das ciências no Brasil e ensino

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Resumo

O presente trabalho sobre as Viagens filosóficas portuguesas ao Brasil no século XVIII tem o objetivo de expandir as temáticas e abordagens da história das ciências no Brasil, abrindo espaço para o debate sobre como o trabalho com as práticas, técnicas e representações científicas possibilita desenvolver metodologias de ensino que abordem temas brasileiros em seu contexto. A partir do material, retirado de um banco de dados biobibliográficos sobre os viajantes, traçamos redes de relações entre políticos, desenhistas, engenheiros, cartógrafos, gravadores, naturalistas e a população local. Para a divulgação dos dados, o material nos desafiou a pensar em propostas de escrita biográfica dos viajantes no ambiente virtual. O espaço permite que o trabalho afiance duas escalas de importância, ou seja, realce o papel particular dos viajantes, demonstrando singularidades, e garanta a análise dos contextos sociais pelas relações interpessoais na perspectiva espaço-temporal. No entremeio dos formatos biográficos e refletindo sobre o caráter híbrido do gênero, definimos que a formulação de micronarrativas asseguraria a escrita biográfica construída sobre os viajantes. A escrita de textos curtos será conduzida especialmente pela biografia modal, apontando as redes de relações sociais do sujeito, e pelos biografemas, caracterizados pela produção de uma impressão biográfica momentânea. Por um processo não-linear da História, a escrita biográfica e a criação de hiperlinks permitem que o caráter complexo das relações do período se reflitam nas micronarrativas formuladas.

Palavras-chave

Escrita biográfica – Ensino de ciências – Viagens filosóficas – Divulgação científica.

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Introduction

Science developed in Brazil along the colonial period remained little known and appraised both in the school and in institutions of non-formal education. When mentioned in school, the history of science, in most cases, is restricted to biographical aspects of scientists, to whom great discoveries or theories were attributed, creating an imagery of great geniuses of science and stressing the individual component in research, to the detriment of controversies and collaborations involved in the scientific community. Science in peripheral contexts, which is the case of Brazil, is minimally covered in research about the history of science and its teaching (SILVA et al., 2008).

Studies on history of science conducted until the 1970's have constructed their narratives starting with scientific events associated with contemporary science and, from then on, they sought the origins of the great concepts or discoveries in the past. According to this view, European and American science were overvalued, because both had become the prevailing paradigms along history. This historiographical method led to omit several important events in the history of Brazilian science, considered delayed in relation to European science. Even, researchers who studied science as a Brazilian cultural phenomenon, as in the collection named *As ciências no Brasil* (science in Brazil), organized by Fernando de Azevedo (1955), overvalued the work performed in Europe to the detriment of the knowledge produced in peripheral countries, namely, those from the South hemisphere.

In the last years, Brazilian historiography is changing and is revealing new forms of governability, of culture and sociability. There is a renewal in the studies of history of science since the 1980's, as they now take into account the relevance of the scientific activities performed in Brazil (FIGUEIRÔA, 2000). The increasing institutionalization of the area can be seen in several works, which give visibility

to the particularities of the Brazilian science, by strengthening its epistemological identity, made tangible in the local reality and in the social construction of the scientific community. The expansion of research on the history of science in Brazil makes the development of teaching methodologies very fruitful when they deal with Brazilian themes in their context.

By Associating history of science in Brazil and teaching, in this paper, we focus on the report and the analysis about the creation of a material for scientific dissemination, still underway, with biographical micro-narratives of naturalists, drawers, engineers, artists, and mathematicians involved in the preparation and the conduct of the Philosophical Journeys, which traveled a great deal of the Portuguese America, in intense relation with continental Portugal and the Portuguese colonies in Africa and Asia. We will then deal with the local dimensions of the science developed by the late Brazilian colonial period in association with the projects of colonial domination outlined for the Portuguese World, highlighting the political context of the time, the institutional framework, and the scientific practices, techniques and representations developed in the journeys and which may be covered by teaching.

Luso-Brazilian Philophysical Journeys

In the late eighteenth century, Portugal performed an intense effort of natural and geographical investigation of its colonies, materialized in the *Philosophical Journeys*, a name concerning its main scope for the observation and interpretation of nature in the various domains of natural philosophy, such as physics, chemistry, zoology, botany, and mineralogy (CARVALHO, 1987). The *Philosophical Journeys*, taking place between the late 18th century and the Independence of Brazil, are a reflection of the Portuguese colonial dynamics, either politically or economically and culturally (DIAS, 1968).

The period we have analyzed includes the decline of the colonial era, since the second half of the 18th century until the Independence of Brazil. In Portugal and in Brazil, at that time, social, cultural and political changes were very intense, and gave rise to new configurations in the relations between the metropolis and the colonies. Even though Enlightenment in Portugal and Brazil has already been quite studied¹, due to its importance for the history of science and arts, there is still a lot to be investigated. The moment is emblematic because of the reforms in schooling, when experimental science and rational logic were introduced. Educational paradigms were set up and implemented through practices inscribed in the new architecture of power, as result: the creation of scientific institutions and spaces of sociability, that were essential for the development of the *Philosophical Journeys* and the relationship between the travelers (ARAÚJO, 2000).

The materials resulting from the journeys consists of a variety of documents, including instructions, diaries, memoirs, reports, drawings, maps, and collections of natural history. Such documental sources are representations about the Brazilian nature in the 18th and 19th centuries and were studied by historians who were interested in the various scientific branches covered in the journeys. The possibilities of creating educational biases about these materials are huge and have been little approached by teaching.

After notice the immense documental scope of the Scientific Portuguese Journeys and its importance for the understanding

of the Portuguese colonial dynamics was assessed, the texts and images resulting from the journeys were systematized and analyzed in the M.A. and PhD research by Ermelinda Pataca (2001, 2006). The main relevance of these works lies in the great systematization of data spread in Brazilian and Portuguese libraries and archives as well as in the analysis of representations such as texts, images and objects, establishing connections between materials of different kinds and interpreting the complexity involved in the studies of natural history and the colonial geographical investigation. To contextualize the representations and how they were re-signified based on the connection between the pieces of information, we conducted detailed and circumstantial analyses about the whole set of travels which covered the Portuguese Empire in the second half of the 18th century. With the purpose of appraising the history of the relations between art and science in Brazil along the colonial era, our research was conducted in the realm of the history of science, in an : interdisciplinary dialogue with the history of arts, in a contextualized way, highlighting the political, geographical, social, and economic issues at that time.

Upon the analysis of the huge documental collection, some issues were highlighted as they were key to reenact the everyday routine of the travels, such as the geographical areas being explored, the scientific and artistic institutions involved, the natural products studies, the technical-scientific composition, the networking between travelers and the scientific and political command of the trips. We designed a framework of the *Portuguese philosophical travels* that had been sent to the colonies, locating them in the policy of colonial exploration in the period, as well as the scientific environment at the time. This framework will be taken as the starting point in the production of the material for scientific dissemination.

1- We think that the main work for the historiographical renewal about the Luso-Brazilian Enlightenment was the one by Maria Odila da Silva Dias (1968). Afterwards, historians who are concerned with the colonial period seek to understand how the introduction of scientific activities were determinant in the context of the late colonial era in Brazil. We highlight the works by Ronald Raminelli (2008) and Raminelli and Bruno Silva (2014), Lorelai Kury (2004) and Magnus R. de Mello Pereira and Ana Lúcia Rocha Barbalho da Cruz (2014). Portuguese historians also have taken a closer look at the Brazilian scientific context, as it the case of Miguel Faria (2001) in the history of arts, João Carlos Brigola (2003) who investigates the role of museums, and Ângela Domingues (1991) who examined the relations between the *Philosophical Journey* and the commissions in charge of defining the borders.

From documental research to scientific publicity

One of the ways to associate historical research with its publicity is to develop tools such biographical and bibliographical inventories and dictionaries. Devised along the data analysis with the purpose of preparing a PhD dissertation (PATAKA, 2006), *Dicionário biobibliográfico* (bibliographical dictionary) was key tool for the documental research as it allowed a global investigation of who were the travelers. In the making, some descriptors were defined in order to standardize data about travelers, such descriptors are presented as follows:

Charter 1: Biographical and bibliographical data for the making of the dictionary

Biographical data	Bibliographical data
Date and place of birth and death	Manuscripts
Affiliation	Active correspondence
Education and training	Passive correspondence
Titles and military patents	Documents about the author
Activities	Publications
Institution he as was a member of	Iconography
Interpersonal relations	Cartography
Supplementary information	References

Synthetic descriptions of biographical aspects of naturalists allowed to outline a general picture about their education & training and their work, as well as the institutional affiliations and the networking among travelers. Detailed systematization of the bibliographical production yielded data that has not yet been systematized by the major bio-bibliographical dictionaries, as we present in great detail the written and iconographic sources. We highlight the details in mail correspondence as a key

documentation to outline the interpersonal and inter-institutional networking of travelers, as they enable to reenact the everyday life of travels by providing information about the places they have visited, the products they have investigated, as well as weather conditions, supply and labor force availability to make the travels conduct.

Our current challenge is to utilize data from the *Dicionário biobibliográfico* (bibliographical dictionary) to develop materials for scientific publicity about the life and work of travelers. Thus, we devised a project to implement bio-bibliographical data in the website of the *Brasiliiana Library* (USP), by setting up the group Travels, Art and Science in the Portuguese World, with scholarship holders Cristiane Borges de Oliveira (undergraduate in Literature), Fernanda Lara Brandão (undergraduate in History), Fernanda Felix da Conceição (undergraduate in Pedagogy), and Camila Franco (undergraduate in Geography). This heterogeneous group has contributed for a further analysis of data: through an interdisciplinary perspective, reading of *Philosophical Journeys* again was more fruitful due to the multiplicity of voices. The scholarship holders defined strategies to disseminate biographical and bibliographical data in order to outreach high-school teachers. After materials had been systematized, teaching approaches were considered to include Brazilian topics in subject matters such as history, arts, geography and the sciences of nature, in addition to the teaching of the students' own mother tongue from documental sources in 18th century Portuguese.

The main challenge was to overcome the material's role of repository for bio-bibliographical information, as it might lead to a teaching based on the transmission and memorization of pieces of information. We then started thinking in creating a multimedia material with educational propositions through interactive strategies and by using texts that provide a historical contextualization of

the scientific journeys. Some authors argue that history of science may foster a more contextualized and critical teaching of scientific activities. Hodson (2011) advocates that teaching science should be built on three major elements: learning science, that is, building conceptual and theoretical knowledge; learning about science – develop an understanding of nature and the methods utilized by science, assessing the complex interactions between science, technology, society and environment; and, last, making science – in order to develop skills related to scientific investigation and how to solve problems.

The preparation of materials to give publicity about the scientific journeys was based on three different factors, taking into account the collection's accessibility. The documentation of the journeys is spread among archives, libraries and museums both in Brazil and in Europe (mainly in Portugal and in France). The documental dispersion of the *Philosophical Journeys* started after Napoleon's army invaded Portugal, in 1808, when the collections, drawings and texts of the *Philosophical Journeys* were handed to French naturalists from the Museum of Natural History in Paris. Although the manuscripts and iconography of the expedition returned to Lisbon in 1814, upon Napoleon's fall, the zoological and herbal materials remained in Paris (where they have been still today). The specimen and drawings from the journeys were then studied by Etienne Geoffroy de Saint-Hilaire, Georges Cuvier, Bernard Germain de Lacépède, who did not mention the origin of the samples they had collected (TEIXEIRA, 1992; GOELDI, 1895).

Considering such characteristics, the reflection about the period of the *Philosophical Journeys* intends to expand the access to the documentation through digital media. The material will enhance the value of the identity of science in Brazil, making the usual approaches to the teaching of science more complex, by considering the universality and

generality of knowledge, for the exploration of the local diversity in terms of culture and nature. Such concept will be facilitated by the nature of the scientific knowledge built along the journeys, based on natural history, which was characterized in the 18th century by the development of local practices for the creation of global collections (LOPES, 2005).

Throughout the process, we have developed strategies to visualize the dialectical relationship between local and global level, that is, starting from the singular items to reach a generalization to apprehend the whole. Thus, we will look at the distances taken by the travelers, presented in geo-referenced manner, since the local scale up to the global scales, to present the movements of the Portuguese Empire and the relationships among the American, African and Asian colonies.

We have dealt with the complexity of science, in its epistemological dynamics and in the political and social relations. Understanding the context of the journeys is facilitated by the writing of biographical type, and adds to the image of travelers the relationship with space and time in the process of creating practices at that time, taking into account that the use of biography, in the current context of how history is articulated, breathes in an area of greater acceptance (DOSSE, 2009). Science about the contents of the *Philosophical Journeys* allows a new reading of the Brazilian history of science in a more complex way.

The growing interest of the public for historical issues demands reflection on new ways of writing biographies. Mary Del Priore agrees with that, as she says that today historians have to re-think their writing and create new forms of giving publicity to their studies, in a variety of media such as museums, patrimonial education, historical novels, etc.

Brazilian historians will have to rethink what types of text they will produce including what will be the role of historical biography, so efficient to get to know the

past. Currently, not to meet exclusively the hermetic demands of the Academy, but also to respond to a social requirement or demand. There are thousands of readers for such a cultural product (DEL PRIORE, 2009, p. 14).

In agreement with the author mentioned above, we advocate the need to reflect about the biographical writing, in search for more adequate forms of publicity, meeting what the public demands. In our group, debates around this issue were rather comprehensive, and we ended up reaching a type of writing that meets the specificities of the virtual world.

Biographical writing: from the dictionary entries to the micro-narratives

Initially, the group proposed biographic entries covering the individuals involved in the *Philosophical journeys*, to be written based on the information systematized in the *Bio-bibliographical dictionary*, in which there are brief descriptions of the life and the bibliographical, cartographical, and iconographical production of the travelers, organized in different labels (descriptors).

Writing the entries would be done in groups about the performance of actors taking part in the journeys. However, when defining the theoretical and the biographical writing, we came across new issues that made us think if doing the entries was really adequate, as they follow a tradition of printed publication in dictionaries and this does not completely fit the virtual and interactive media we intend to utilize. Moreover, the synthetic writing of entries did not allow showing the complexity of the relationship between the life and work of the travelers in short texts, as some were more active than others, which would require further biographical explanation.

Writing the entries showed us the need for theoretical orientation from different areas. The mention of the book *O desafio biográfico*

(the biographical challenge), by François Dosse (2009) led us to an interest in the theory of the biographical style, which, for a long time, was marginalized and made it difficult to classify it as an organized discipline, but based on the new social configurations, would they be part of an important source of information regarding an individual (in a singular way), a society (in a plural way) or the relationship between both. Reading Dosse brought up issues concerning biography. We started with the hybrid feature of the biographical writing, which involves fictional aspects, made up by the writer, in relation to the real experiences included in a person's biography, as well as data connected with the memory, either individual or social, as elements of the biography. The biographical practice navigates in the relationship between documented facts and memory, fiction and reality.

Amidst such different possibilities, we have chosen the style of modal biography in the writing, so that it would ensure the transition between the peculiar aspects of an individual's biography and the collective issues that are associated with that person. Going beyond a biography focusing a linear narrative of a single person, the singular is decentralized in order to represent the individual in a broader perspective to illustrate the collective.

Choosing the modal biography was the way our group found to express the history of science in Brazil in a collective fashion and not based on the individual character of the travelers. The importance of the relation between the travelers and the milieu enable us to analyze the social configuration of the time when the *Philosophical journeys* took place. Thus, Miguel Faria (2001) wrote the biography of José Joaquim Freire, a drawer in the *Philosophical journey of Alexandre Rodrigues Ferreira*, showing the social role of the military personnel, cartographers and drawers of natural history in Portugal in the period studied, which expressed his time and his social milieu. Networking between travelers

and individuals belonging to the Portuguese administrative bodies was also investigated by Ângela Domingues (2000). Considering a more comprehensive frame of relations, pointing to complex interconnections between naturalists, drawers, the military, administrators, artists, engravers, cartographers and practitioners, becomes a great challenge which may materialize in the virtual media containing the plot and its unfolding so that we can understand the social role of naturalists.

Thus, the modal genre allowed us to think about this broader network of social relations, revealing the collective nature of the scientific, technical and artistic activities in the Philosophical journeys. However, such biographical genre would not completely fit the space and time approach that we wish to include in the geo-referencing process. Due to this need, we found an interesting possibility for writing biographies in the format of biographemes regarding the perception and the experiences of travelers in their roaming around the Portuguese World.

Biographeme is about a memory that cannot be done in the linear narrative of events or through the fixed frame of a person's biography; that is, from the biographemes it is possible to report small shreds of life, and it is unnecessary to worry about continuity. This sort of writing, according to Dosse (2009), never crystallizes. Thus, it is assured that the analysis will operate with fragmentation, by choosing passages that are relevant in writing the entries, which enables as mentioned above to access more comprehensive information from the reference materials, digitalized by digital libraries and/or by other units providing similar materials, within or outside Brazil.

Blending two different types of biography reveals the hybrid nature of this genre. The types of biographical writing will serve as a support for the analysis to be conducted in accordance with the objects available and the contextualization necessary in the making of each biographical narrative. Dosse stresses the

adequacy of blending models, and highlights that their dynamics nature prevents from using a single model of analysis, deemed to be irrevocable, threatening the confrontation of different analyses and thus permits to highlight the intentions that are implicit in the models considered to be ideal. Dosse (2009, p. 214) argues that:

These models must be articulated with field research along which the theory remains connected with the empirical activity of observation. The circumstances play the main role in determining the behavior and adjustment of the justification processes. Such dynamic model, articulated with the intelligibility of the action, enable from one hand to avoid the reef of the introspection of the implicit intentions and, on the other hand, the reef of mechanic objectification which tends to link the action to systemic causalities.

In the writing, we have defined that the best way to deal with the life and work of the travelers would be through the micro-narratives, in brief analysis built from information contained in the representations made by them, such as travel diaries, mailing, texts, drawings, and maps. Micro-narratives disseminate the travelers' perception of the Portuguese World, highlighting the space and time dimensions that characterize the flow and decline of ideas, products and populations throughout the colonial ambience (RUSSELL-WOOD, 1998).

To give the journeys publicity, it was necessary to worry about the language used when writing the texts, which should maintain the characteristics of the time, but simultaneously it should be clear and concise to make up the materials intended for scientific dissemination. Using explicit references to the digitalized materials made available in the web, the reader can guide his or her reading according to their initial pledge or

find unexpected facts and sources during the research going deeper in the knowledge of the Philosophical Journeys depending on the reader's interest. Having this process in mind, we selected excerpts of relevant texts which bring to our current time the traveler's look in the period of the Philosophical Journeys, ensuring from hyperlinks the connection with the reference texts in their entirety – mainly the books available in digital libraries. There is also a concern to connect the micro-narratives with other websites, creating references to studies that provide similar contents on internet. With browsing available among different texts, the reader will interact with his/her object of study and will choose the paths his/her reading will take in, according to his/her knowledge and/or interest in the journeys or a given personality.

Writing the micro-narrative enables to assume a more complex social perspective of the biography, including the individual's actions in connection with the socio-historical and spacial influences. Thus, one may think in a historical writing that is not linear and which, due to the process of interpretation and analysis of the data available makes room for new ways of looking at the same period/object/space, by means of other analyses and, in the context of teaching, in different areas of knowledge.

Geo-referencing biographical information

Due to the possibilities of inter-textual and interactional relationships that online texts generate, we believe that the biographies of travelers might be written in a variety of dimensions, highlighting the relations between the several individuals involved in the colonial networking. For such, data are presented in multiple scales, from peculiar and detailed aspects of the life and work of each traveler to aspects that define identity elements of collective dimension in the groups of travelers. The biographical writing itself, that includes from the particular dimensions of the individual

to their historical context, turns out to be a facilitator of this approach.

We defined that data to be presented on the interface should be through the Geo-reference Information System (GIS), so that data is provided by means of space and time dimensions. As we had realized that the writing entries would not be adequate, we figured out the micro-narratives, to be inserted in the interface by using GIS, showing the instantaneous perception of local dimensions as well as the generalizations made for the whole set of journeys. Building relationships between the micro-narratives takes place when users browse the contents, allowing for a variety of paths.

Browsing enables the user to view data in either micro or macro scales in a movement of contextualization and generalization of the Portuguese World. Mauricio Compiani (2007) mentions how important it is to utilize scales in teaching and proposes two movements to relate the local to the global dimension, which are: horizontality – or contextualizing reality by defining singular elements – and, afterwards, verticality – towards de-contextualization and generalization.

The local dimensions and their relations with global view may be covered by the history of science, especially natural science such as biology and geology. Margaret Lopes, by providing subsidies for the teaching of the history of science, builds a frame to understand the development of natural history between the Renaissance and Enlightenment (15th through 18th centuries), demonstrating the definition of key areas, such as botany, zoology and mineralogy as “knowledge supported by local practices and global collections” (LOPES, 2005, p. 459). The author emphasizes the specificities of natural science, outlining the importance of local aspects in the making of science, in contrast to experimental science with inductive method. Thus, building a platform to present the information resulting from the journeys in the places explored contributes to produce contextualized knowledge.

The journeys had a strong political centralization in the Minister of Navy and

ultramarine domains, which were controlled from the metropolis. We found a steep difference between two Ministers: Martinho de Melo e Castro (1777-1795) and D. Rodrigo de Souza Coutinho, (1796 to 1802). Linked to the political ambience, we investigated the status of travelers in the face of power spheres in each ministry. Some personalities who centralized the planning of journeys in the first period, as Domingos Vandelli, started to act in an intermediate manner under the administration of D. Rodrigo. We found out that the scientific control over the journeys from the metropolis was determined by the affective proximity of travelers with their masters, by the institutional affiliation of naturalists before leaving the Kingdom and by interpersonal relationships.

We mapped the journeys undertaken by the two ministries in order to comprehend them in a global framework. In the ministry under Martinho de Melo e Castro, we analyzed thoroughly the everyday life of travelers in the field and we were able to map out the more detailed moves of naturalists in the Portuguese America Portuguesa, as can be seen in figure 1. Based on the same geographical chart, in figure 2, we just distributed the travelers throughout the regions they covered in the Portuguese America under the administration of D. Rodrigo de Souza Coutinho, but we did not pay a lot of attention to the mobilities.

In the first ministry, the number of naturalists was lower and emphasis was given to the Brazilian Amazon and the areas of gold mining, such as Minas Gerais and Mato Grosso. The main journey was commanded by Alexandre Rodrigues Ferreira (1783-1792), who covered the rivers Tocantins, Amazonas, Negro, Branco, Mamoré, Guaporé up to the city of Cuiabá, and conducted intense investigations in frontier areas, supplementing the commissions in charge of demarcating the borders. Bipolar administration between the State of Grand-Pará, whose headquarters were in Belém, and Rio de Janeiro, is shaped by the complementarity to the Expedições botânicas (botanic expeditions) of

Friar Veloso in the captaincies of Rio de Janeiro and São Paulo (1782-1790). In addition to these journeys, we highlight the investigations by Joaquim Veloso de Miranda in Minas Gerais, by Baltasar da Silva Lisboa in Rio de Janeiro, by Joaquim de Amorim e Castro in Bahia and by Manoel Arruda Câmara in the Northeast part of Brazil.

In the journeys under the ministry of D. Rodrigo de Souza Coutinho, we found a more comprehensive coverage of the territory, especially in the coastal areas. At the time, the search for saltpeter required to manufacture gun powder, strongly utilized in the context of the imminent invasions by Napoleon, was valued in the set of the scientific investigations in that period, something that clearly appears in the instructions and in the representations arising from this set of journeys. The hot and dry weather in the Northeast of Brazil would be quite favorable to explore and produce saltpeter.

It would not be suitable to provide here details of the everyday activities in the journeys, but we highlight that the singular natural and geographic characteristics of the places investigated by naturalists were decisive to acknowledge the territory. Such activities could be described with their minute aspects in the micro-narratives.

Biographical dimensions of the travelers

In our research, we collected information concerning eighty travelers, out of which about forty had a record included in the bibliographical dictionary and other forty travelers already have their data collected and systematized. Upon systematization, we analyzed the political, scientific, technical, artistic, literary and editorial functions to characterize the personalities as governors, naturalists, mathematicians, physicians, surgeons, religious persons, drawers, preparers, the military and engineers. This set of categories

Figure 1: Demonstration map of the routes taken by travelers under the administration of Martinho de Melo e Castro (1777-1795).



Made by Daniel Catoia. Cartographic basis: LEME, Antonio Pires da Silva Ponte. *Carta da Nova Lusitânia...* Lisbon, 1798. Copy from Laboratory of the World, 2004.

Figure 2: Areas travelers went through under the administration of D. Rodrigo de Souza Coutinho (1796-1805).



Map made by Camila Franco. Cartographic basis: LEME, Antonio Pires da Silva Ponte. *Carta da Nova Lusitânia*. Lisbon, 1798. Copy from the Laboratory of the World, 2004.

according to their functions is not strict, especially because during the journeys each team performed integrated actions due to the adversities they had to face when going through a route. However, the names of the functions help us define the identities of the travelers, going further and deeper in the analysis of their skills and practices.

In order to write the micro-narratives, we defined biographical dimensions associated with political, material, cultural and environmental aspects, which were determinant in the making of the micro-narratives, shaping the singularities of each individual involved in the plot of journeys, as well as the social relations they had to each other.

The travelers' moves between the metropolis and overseas may be analyzed in relation to the field and to the office. We separate their practice in three fundamental moments, which unveil peculiar characteristics of the work done by the travelers: preparation of the journeys in Portugal; fieldwork when the journeys actually took place in the colonies; and, last, the preparation of materials to be recorded upon completion of the fieldwork. In cultural terms, along the three phases of the journeys, the travelers' work was materialized in practices, techniques and representations, conditioned both by the theoretical references utilized at the time and the technological innovations resulting from the practices.

At all times when travelers were in action, cooperation between teams of individuals various skills and functions made it possible to develop multiple types of knowledge configured in the networking, expressed both in the institutions the travelers had a link with and in the characteristics of the places explored at each moment. By analyzing these factors and especially the connection between them, we found the singularity of the individuals, built through encounters and mutual influences among the travelers on movement in the Portuguese Empire. We analyzed the journeys in the context of the Portuguese World in the late

18th century, but with the natural and cultural characteristics peculiar to each location, under the circumstances of the development of natural history and geography. Capturing these local characteristics is a key tool to understand the scientific innovations and the technical development resulting from the movement of travelers throughout the Portuguese World, according to the very definition of natural history at the time, which was made up of local practices for putting up global collections (LOPES, 2005).

Among the scientific practices, we highlight the role of experimentation and direct observation of nature as conditioners of a traveler's work. According to Antônio da Costa Sá (1783), the journey might be characterized as an "exact observation of the countries", that is, the direct observation of reality materialized in performing the journey.

According to Jardine, Secord and Spray (1996), the practices of natural history are analyzed through a cultural or anthropological perspective. Thus, the authors characterize the sets of practices as: material, social, literary, bodily, and reproductive. Here we talk about the material practices, that is, what is related to the making, manufacturing and changing of objects – performed mainly by the activities of collecting, transporting and preparing specimens – or of preparing books, illustrations, and experiments. In the whole of the *Philosophical journeys*, which also had the purpose of providing the museums of natural history with botanical, zoological, mineralogical and ethnographic collections, the practices of collecting, preparing and transporting specimens were extremely valued, as clearly mentioned in the instructions for the journeys (PATACA, 2011).

In relation to agriculture, the study and utilization of agricultural technology was emphasized, a concern that is present in the speech of most naturalists who debated the matter during the administration of de Martino de Melo e Castro. Due to a policy aimed at

renewing agriculture and introducing new rural techniques, D. Rodrigo ordered a series of actions such as requiring from governors of captaincies reports about the processes employed in the preparation and cultivation of exportable products and the command to collect native plants and minerals to be sent to the Kingdom (DIAS, 1968).

Concerning transportation, D. Rodrigo recommended water routes or land roads to be set up, combining navigation to convey commodities and irrigation to foster agriculture. Hydrographic studies were also essential to develop and investigate the mining techniques for gold, recorded in the representations arising from the *Philosophical journeys*. We analyzed such representations to assess the technical and scientific references in association with the policies of colonial settlement and exploration.

The intense effort to map mineralogical sources in Portugal and its colonies reveals the imperial dimension and the interchanges of knowledge between Europa, Africa, and America at the time. In their investigations, naturalists followed the journey instructions, consisting of European technical-scientific instruments, with frequently mentions to underground mining and the application of chemistry, such as the use of the amalgam of gold and mercury. In the field, travelers found specific situations, especially when creating mining technique, utilizing complex hydraulic processes outdoors, by means of the technology developed in Brazil, using machines to drain water. Thus, implementing techniques and knowledge acquired in Europe did not completely complied with the local conditions, generating some controversies and the feeling of backwardness. Mapping the venues where mineralogical investigations took place and the mining areas helps understand the strategies for mining development at the time.

Setting up teams is associated with defining journey routes, conditioned by the products that should be investigated, by the phenomena observed and by the development

of techniques in natural history. In general, the guiding issues for naturalists in the field were: occurrences of saltpeter; introduction of new farming models, especially mealybugs, cinchona, indigo, cocoa, and coffee; agricultural/industrial development impelled by technical farming innovations; a detailed inventory of water resources and possible linking channels between the captaincies. We reviewed extensively the detailed observations by naturalists about the objects of their real investigations, at each moment, assessing how geographic and geological realities or the local environmental conditions determined the dynamics and results of journeys, which became essential for mapping specific themes.

The set of practices was summarized in several representations, such as images, collections and texts made by the travelers both in the field and in the office, materializing the distances they went through and the stays all over the Portuguese World. The representations are also characterized as literary practices (JARDINE; SECORD; SPRAY, 1996), but due to the extent and diversity of factors involved in such practices, we will deal with them as a separate dimension.

Soon after the journeys, some of the travelers were committed to publish the resulting materials, which required the establishment of printing houses, and the most important of them was *Tipografia do Arco do Cego* (the blind man's arch printing house), operating between 1799 through 1801. In addition, new professional became part of the articulations in the network associated with the travelers' activities: engravers, drawers, casters involved in printing the works of natural history. We analyzed the printed representations and the set of practices associated with them, especially the intrinsic connection between the development of natural history and the press.

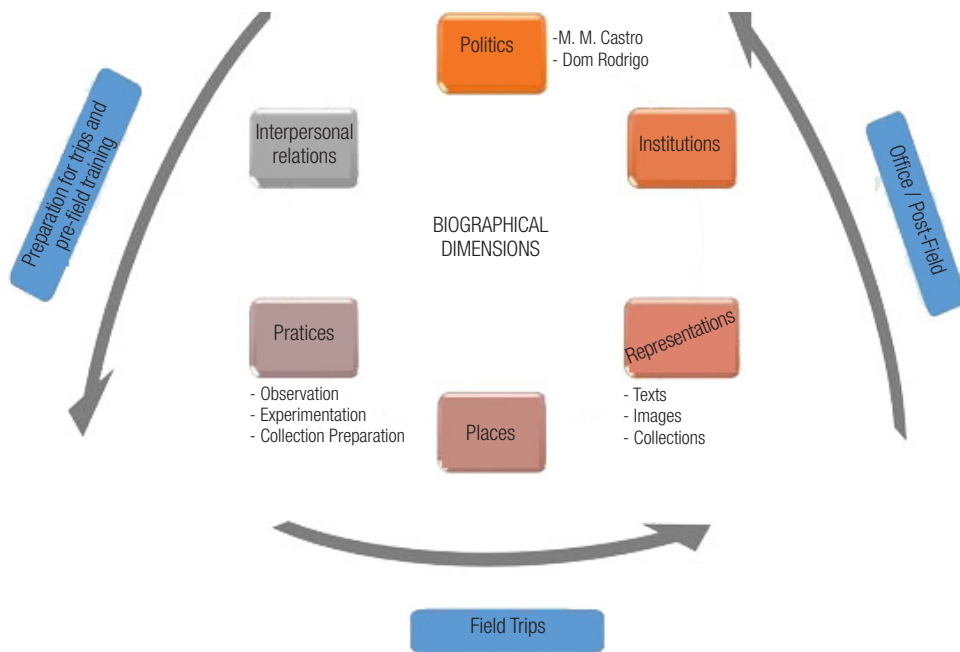
Biographical dimensions of travelers can be seen in figure 3. For each individual, we considered how the dimensions are related and intertwined, determining the biographical

singularities. Setting up groups of travelers was done in a two-fold way: by identifying the connections between individuals, through interpersonal relationships; or homologies of biographical dimensions. As a result, it is possible to understand the social role of travelers.

In order to apprehend singular and social features of travelers, we initially chose a single

individual to develop the micro-narratives. From this traveler, we were able to identify his network of relationships in an effort to unveil the links with individuals of various biographical dimensions and homologies with other travelers. Interpersonal relations are described in micro-narratives and reveal the cooperation between individuals towards the complexity of the

Figure 3: Biographical dimensions of travelers on the move in the Portuguese World



Source: by Camila Franco.

activities involved along the journeys and the practices of natural history at the time.

Final comments

Writing biographical micro-narratives, disseminated through virtual media together with documents about the *Philosophical journeys*, contributes to a better understanding of the great Portuguese enterprise of making a *Natural history of the colonies*, and at the same time it is a tool to give publicity of the journeys to non-expert audiences, strengthening the debate in the context of basic education. The possible uses of the cyber

media bring new challenges to biographical writing and the setup of bonds among the representations, broken up along the two last centuries in several attempts of preserving the documents and their publication. Creating micro-narratives arose from the debate about how to write biographies of great deal of travelers and their relationships, showing the singularities of each individual in relation to the places he went through and his physical and symbolic positions in the scientific and educational Portuguese institutions in the late 18th century. The micro-narratives present biographical moments which may either be articulated with the individual's

work and activities, revealing his singularities, or be connected to the micro-narratives of other travelers, in building rather complex relationship networks, which demonstrate the collaborative nature of the journeys in the configuration of social groups.

Identifying cooperation networks among complex teams provides a more comprehensive understanding of the scientific work, abandoning traditional views of the great inventions and discovery by single individuals, visualized in images of great geniuses, in order to set up a collective frame to identify articulating among the personalities which remained unseen in the teaching of science.

Biographical singularities were especially found in the contact with the natural, social and cultural diversity of the Portuguese empire and in the detailed descriptions of animals, vegetables, minerals and the native Indians. Building the theoretical references adopted by the naturalists to a large extent was shaped and changed during the journeys, resulting from multiple encounters with the local population and the investigation of the natural diversity existing in the colonies. Associations between individuals took place to solve problems experienced by travelers in the everyday routine of journeys and they reveal activities that are peculiar to the reality of the Portuguese America, in their relations with the several colonies of the Portuguese World. Here, historicity of science is marked with the local dimensions, creating contextualized situations to be used in teaching. Presenting the routes taken by travelers, with a highlight of their mobility throughout the Portuguese Empire, by using geo-referencing, with sequences of micro-narratives which emphasize local issues, helps demonstrate the singularities of the individuals

with a writing of *biographemes* that give details of the instantaneous perception of travelers about the places they were investigating.

From a dialectical association crossing a number of data and realities experienced in the Portuguese World, we went on to seize a movement of verticality, or contextualization of reality, perceiving the global dimensions. Such movement enables us to go from singularities to generalities involved in the scientific activities and in the whole set of the *Philosophical journeys*. In the collective and generalizing picture of the journeys, the highlight is the practices to prepare and preserve the collections, described in detail in the travel instructions. In addition, the standardization of the language was consolidated in the classification of the botanic, zoological and mineralogical specimens, as well as in the new names adopted by the modern chemistry.

Developing scientific practices took place both at the office and in the field, due to the engagement of professionals who at the time were already taking different assignments in the fields of natural history, drawing, and cartography. Dealing with the *Philosophical journeys* in basic education may highlight the interdisciplinary relations in the production of scientific knowledge. After the making of this set of tools, we expect that high-school teachers, from several areas covering Brazilian themes in their curriculum, such as history, geography, biology, arts, and Portuguese language, for example, may take advantage of the material we have analyzed in order to include the history of science in Brazil into the student's real life, bringing them affectively through the contact with the history of their own country and the possibility of having contact with real materials, by means of hiperlinks, about the period of the *Philosophical journeys*.

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