

The naturalists and the popularization of science

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Paper

I. Introduction

The naturalists' trips were an important process for the acquisition and construction of scientific knowledge and led to significant progresses in natural history. The voyage books, where are described personal adventures, naturalistic observations and aspects of local cultures constituted an interesting literary style with high repercussion in Europe. An aspect that is not usually considered is the role they carried out as tools of science popularization, since they exposed to the readers the knowledge of the time on scientific themes and also scientists' reflections on the new lands, flora, fauna and cultures.

Recent works about the science of this period attracted the attention to new aspects related to the naturalistic practices (Lightman, 1997). The main characteristic of these contextual studies has been its emphasis in the way for which the scientific ideas are immersed in the material culture. However, works analyzing the naturalists' interaction with the local communities are still rare. One of the most interesting frontiers of study is the one that appears among the traveling scientists and the non scientific personnel in contact with them: naturalistic colleagues, farmers, amateurs, adventurous, indigenous groups, hunters, slaves, bureaucrats, priests, diplomats, local authorities, military and naval personnel, transporters, employees of several types, etc.

The voyage narratives done by the naturalists frequently had a dazzle tone on the wonders of nature. The publication of their books and also of articles in newspapers and magazines played a significant role for the construction of a network between the scientific community and the general public. These books also brought meticulous descriptions, from the eurocentric point of view, of the encounter of different peoples, languages and cultures, as well as of the relationships between European immigrants and the local populations. They also contributed a lot for the social creation of an imaginary panorama on the nature of the tropics and on the local social customs. For instance, the presence of the Amazon region in the European mentality has been modeled along the centuries, shaped by naturalists, adventurers, entrepreneurs and, more recently, environmentalists. These representations compose, even if in contradiction, a complex and changing image. Since the beginning of the century XIX Brazil has been visited, with a feverish interest in tropical nature, by a wide range of naturalists - scientists or amateurs - coming from several countries, in organized expeditions or in isolated trips. In Humboldt's footsteps in South America, came Karl von Martius and Johann von Spix, Auguste Saint-Hilaire, G. Langsdorff, Charles Darwin, Richard Spruce, Henry Walter Bates, Alfred Russel Wallace, Louis Agassiz, and many others. Some of these expeditions had important impact in science, specially in natural history, like the ones by Darwin or Wallace.

There were also other naturalists and less known travelers, some of them of local origin, that worked and contributed to the development of natural history, usually in a close relationship with the first scientific associations and natural history museums. In fact, hundreds of naturalists have visited Brazil during this period, after the permission for foreign expeditions and the political independence of the country. In the Brazilian case, several naturalists remained living in the country and some of them had prominence paper in the process of introducing scientific research in the country, like Fritz Müller and Louis Couty.

We analyzed here travel books, letters and articles of the following naturalists: Von Martius and Spix, Wallace, Bates, Agassiz. All of them get recognized success in collecting and in the identification of new species of plants and animals in Brazil. Wallace made important contributions for the bio-geography and formulating the theory of the natural selection (at the

same moment as Darwin). In its trip to the Amazon, Bates and Wallace didn't have the same means as Darwin in the travel of the Beagle. Coming from more popular social strata, they depended on their naturalistic activities for the survival: they sent the specimens of insects and birds for being sold in London. They had, therefore, the necessity of using new strategies for developing their field works. One of them was the creation of a network based on the local native population and on foreigners that were in Amazon.

Louis Agassiz, on his side, organized his expedition with wide financial resources and also received the Brazilian imperial government's strong support. Agassiz was a naturalist of Swiss origin living in United States where he got recognized importance in the field of natural history. He proposed the hypothesis of the universal glacial period, and was also an outstanding scientist in the area of popularization of science being one of the most influential scientists of the USA in the century XIX. However, Agassiz is more frequently reminded as one of the main and more tenacious opponents of the theory of the natural selection. The purpose of Agassiz, in its expedition to Brazil, was clearly exposed by him in his travel book:

"I am often asked what is my chief aim in this expedition to South America. No doubt in a general way it is to collect materials for future study. But the conviction which draws me irresistibly, is that the combination of animals on this continent, where the fauna are so characteristic and so distinct from all others, will give me the means of showing that the transmutation theory is wholly without foundation in facts." (Agassiz, 1975, p. 33)

In fact, the tropics had been turned, in the middle of the century XIX, the privileged arena for the exam of the theories on the origin of the species: Darwin, in its passage for South America, had its attention wakened up for the subject. After many years of study and comparisons, and instigated and guided by Wallace's work, he proposed the hypothesis of the natural selection. Wallace, in Amazon and later on in Malaysia, would find in the geographical distribution of the animals - knowledge on which he depended strongly on the information and skills of the native people - a path that, allied to other factors, it would drive him to the hypothesis sent to Darwin in 1858. Several years later, Agassiz tried to find in Brazil the means of showing that the transmutation theory is wholly without foundation in facts, in his own words. The travel books were also read by illustrated people of the visited countries and they contributed, in a certain way, for the diffusion of knowledge in local terms. In some cases, the local situation is also discussed in these books: popular attitudes about science and how was the operation of existing scientific and educational institutions. In these works we can locate also many portions where the naturalists described as their ideas and activities were received locally and as the local inhabitants contributed with knowledge and skills to the field work (Moreira, 2001). However, this direct interaction with the local population has been seldom considered in history of science studies. The result of our investigation brings new interesting aspects: countless references in the documents exhibit the importance of native people for the success of naturalistic task. It is interesting to oppose these personal descriptions with the synthetic format of the scientific articles;! here the references to local collaborators nearly always disappear or are minimized strongly.

Some direct science popularization activities also happened during these trips. For example, in 1865/66, Agassiz accomplished, in Rio de Janeiro, the first local public scientific conferences with women's participation. One of the objectives of these lectures was to disclose its ideas about the existence of a glacial period in Amazon and to present arguments against the theory of the natural selection. In his travel book, that he wrote with his wife Elizabeth, they made interesting comments about the behavior of the Brazilian audiences in these conferences.

II. Voyage books and science popularization

There are many reports where is related the importance of the travel books for stimulating young people to dedicating their lives to natural history. For example, in his journal, Darwin recognized the influence of the reading of Humboldt's Personal Narrative on his decision of becoming a naturalist. On the other side, Darwins' voyage book (and also Humboldt's book) were decisive for stimulating Wallace's scientific interest. This is a first role, in a broad sense, that naturalistic

reports had in science popularization. We will analyze here some aspects related to science popularization that are present in the following voyage books: J. B. von Spix and K. F. von Martius, *Reise in Brasilien*, 1823; H. W. Bates, *The Naturalist on the River Amazon*, 1863; A. R. Wallace, *Narrative of Travels on the Amazon and Rio Negro, With an Account of the Native Tribes, and Observations on the Climate, Geology, Natural and History of the Amazon Valley*, 1853; L. Agassiz and E. C. Agassiz, *A journey in Brazil*, 1868. The general aims of these books are exposed in Darwin's presentation to Bates' travel book: "In his present volume, however, Mr. Bates does not confine himself to his entomological discoveries, nor to any other branch of Natural History, but supplies a general outline of his adventures during his journeys up and down the mighty river, and a variety of information concerning every object of interest, whether physical or political, that he met with by the way." (Bates, 1863, p. 4) Bates' book got an immediate success with several re-editions, the fourth being published in 1876. During his trip to Amazon and Rio Negro, Wallace wrote several letters and articles on themes of natural history that were published in British scientific magazines. He also wrote a beautiful book, that can be seen as a science popularization book, on the Amazon palm trees. In his book, Wallace lists about 50 different types from those plants and discusses their uses by the local population. For writing the book, he depended strongly on the knowledge that he learned with the Indians and the local inhabitants, as he mentions clearly in the foreword of the book.

The initial impact of Wallace's book was small, but after 1870 and until the beginning of century XX, it had several re-editions: 1870, 1885, 1889, 1890 (London) and 1890, 1892, 1900, 1911 (New York). As the Bates' book, it is an excellent book for the popularization of Amazon natural history, especially on the field of bio-geographical and anthropological studies. Several decades before, between 1817 and 1820, Von Martius and Spix were in Brazil. They published an interesting and detailed travel book too. *A Journey in Brazil* was written by Louis Agassiz and his wife Elizabeth for relating his trip to Brazil, the so-called Thayer expedition, in the years 1865/66.

The books cited above were translated to the Portuguese in the century XX. So, only in the last century they could be read by a wider public in Brazil. However, the English versions (or German, in Spix and Martius' case) could be found in some private and public libraries in Brazil and read by Brazilian scholars or illustrated people of the local elite. It is interesting to highlight that the first Brazilian book dedicated to the scientific fiction, *O Doutor Benignus*, appeared in 1875, written by Emílio Zaluar. Using a style similar to Julio Verne's books, Zaluar describes a hypothetical scientific expedition to the interior of Brazil (Zaluar, 1994). He used his own experience on trips and on his readings of naturalistic texts. Von Martius wrote also a not well-known naturalistic romance: *Frei Apollonio - Um romance do Brazil*. The book, with some autobiographical touches, tells the trip and adventures realized by a young naturalist in Amazon; several habits of Brazilian indigenous groups are also described in this book. An important document for the understanding the local panorama in science popularization at this time was written by the French biologist Louis Couty. He had come to Brazil to teach Applied Biology in the Polytechnic School of Rio de Janeiro. Worried with the development of the Brazilian science, Couty wrote the first article of a column dedicated to the news on science in the *Revista Brasileira*, in 1875. He defended strongly the development of the experimental sciences in Brazil and gave special emphasis to science popularization activities. He mentioned the great development of this area in Europe in that moment and analyzed possible ways to stimulate the lay public in scientific matters.

Following the same roads thrashed in Europe, Couty exposed an entire program for science popularization, analyzing the contents that should be prioritized. He proposed a series of activities for the illustrated public, and defended that the real complexities of the scientific problems should not be simplified excessively. But the program proposed by him didn't arrive to be executed; he died very young right after the publication of his article.

Another side of this story is that, in some situations, the scientists or amateurs of the natural history of local origin criticized or reacted to ideas coming from abroad naturalists. These nationalist positions emerged from the perception that foreign scientists has frequently ignored or neglected local knowledge. A fine irony to the naturalists that visited the country and wrote with

arrogance about matters they didn't know well was the essence of the play *A Estátua Amazônia – Uma Comédia Amazônica* (The Amazon Statue – An Amazon comedy) written, in 1851, by the artist and Brazilian naturalist Araújo Porto-Alegre. He criticized specially the French naturalist Castelnau. Scientific polemics with foreign scientists also appeared in some occasions in conferences or in the press. For example, the Brazilian geologist, engineer and naturalist Guilherme Schüch presented a public lecture, in 1865, about the rocky formations in Rio de Janeiro. He offered an alternative explanation ! to the one proposed by Agassiz, a defender of the glacial action in the mountains of this region. In Capanema's little book on the geologic decomposition of boulders in Brazil, resulting from this popular lecture, he wrote about the objective of the book: "I publish this pamphlet under the most popular form it was possible for me, for being also understood by non specialized people..." (Capanema, 1866, p. 2)

III. The naturalists' activities in local processes of diffusion of science

The relationship with the local population was in many cases a decisive factor for the success of the naturalist expeditions. Bates, for example, declared in his voyage book: "I lived, as may already have been seen, on the best terms with the inhabitants of Ega." (Bates, 1979, 202) He wrote too: "I amused myself with the Tushaua and his people. A few words served to explain my errand on the river; he comprehended at once why white men should admire and travel to collect the beautiful birds and animals of his country, and neither he nor his people spoke a single word about trading, or gave us any trouble by coveting the things we had brought." (Bates, 1979, p. 179) In his book, Bates also reported an interesting case of a complex cultural interaction with the Mundurucus: "To amuse the Tushaua, I fetched from the canoe the two volumes of Knight's Pictorial Museum of Animated Nature. The engravings quite took his fancy, and he called his wives, of whom, as I afterwards learned from Aracu, he had three or four, to look at them... . In a short time, others left their work, and I then had a crowd of women and children around me, who all displayed unusual curiosity for Indians. It was no light task to go through the whole of the illustrations, but they would not allow me to miss a page, making me turn back when I tried to skip. The pictures of the elephant, camels, orangutans, and tigers, seemed most to astonish them; but they were interested in almost everything, down even to the shells and insects. They recognized the portraits of the most striking birds and mammals which are found in their own country-- the jaguar, howling monkeys, parrot! s, trogons, and toucans. The elephant was settled to be a large kind of Tapir; but they made but few remarks, and those in the Mundurucu language, of which I understood only two or three words. Their way of expressing surprise was a clicking sound made with the teeth, similar to the one we ourselves use, or a subdued exclamation, Hm! hm! Before I finished, from fifty to sixty had assembled; there was no pushing or rudeness, the grown-up women letting the young girls and children stand before them, and all behaved in the most quiet and orderly manner possible." (Bates, 1979, p. 180) The local attitudes on the scientists' activities were also related by Bates: "I was never troubled with that impertinent curiosity on the part of the people in these interior places which some travellers complain of in other countries. The Indians and lower half-castes--at least such of them who gave any thought to the subject--seemed to think it natural that strangers should collect and send abroad the beautiful birds and insects of their country. The butterflies they universally concluded to be wanted as patterns for bright-coloured calico-prints. As to the better sort of people, I had no difficulty in making them understand that each European capital had a public museum, in which were sought to be stored specimens of all natural productions in the mineral, animal, and vegetable kingdoms. They could not comprehend how a man could study science for its own sake; but I told them I was collecting for the "Museo de Londres," and was paid for it; that was very intelligible." (! Bates, 1979, p. 203)

Agassiz and his wife described several situations where the local people interacted with the laboratory practices of the members of the expedition: "His studies have been the subject of great curiosity to the people about the sitio; one or two were always hovering about to look at his work and to watch Mr. Burkhardt's drawing. They seemed to think it extraordinary that any one should care to take the portrait of a fish. The familiarity of these children of the forest with the natural objects about them - plants, bird, insects, fishes, etc. - is remarkable. They frequently ask to see the drawings; and in turning over a pile containing several hundred colored sketches of fishes,

they scarcely make a mistake, - even the children giving the name instantly, and often adding, "É filho d'este," (it is the child of such an one,) thus distinguishing the young from the adult, and pointing out their relation." (Agassiz, 1975, p. 274) In another situation, in Rio de Janeiro, they wrote: "Meanwhile he has improvised a laboratory in a large empty room over a warehouse in the Rua Direita, the principal business street of the city. (...) A very questionable perfume, an 'ancient and fish-like smell,' strongly tinged with alcohol, guides one to this abode of Science, where, notwithstanding its unattractive aspect, Mr. Agassiz receives many visitors, curious to see the actual working process of a laboratory of Natural History, and full of interest in the expedition. Here also pour in specimens from all quarters and of every kind; voluntary contributions, which daily swell the collections." (Agassiz, 1975, p. 274)

Let us consider now the subject of the public conferences about science accomplished at this period. In his expedition to Brazil, Louis Agassiz realized, in his first stay in Rio de Janeiro (June 1865), a series of public lectures destined to an illustrated public. These conferences were probably the first ones with the women's participation. He and his wife Elizabeth described them in the voyage book: "One word upon these lectures, since we are told by the Brazilians themselves that the introduction of public lectures among them is a novelty and in a certain sense an era in their educational history. If any subject of science or letters is to be presented to the public here, it is done under special conditions before a selected audience, where the paper is read in presence of the Emperor with all due solemnity. Popular instruction, with admittances for all who care to listen or to learn, has been hitherto a thing unknown. The suggestion was made by Dr. Pacheco, the Director of the Collegio Dom Pedro II, a man of liberal culture and great intelligence, who has already done much for the progress of education in Rio de Janeiro; it found favor with the Emperor, who is keenly alive to anything which can stimulate the love of knowledge among his people, and at his request Mr. Agassiz has given a course of lectures in French in a variety of scientific subjects. He was indeed very glad to have an opportunity of introducing here a means of popular education which he believes to have been very salutary in its influence among us. At first the presence of ladies was objected to, as too great an innovation on national habits; but even that was overcome, and the doors were opened to all comers, the lectures being given after the true New England fashion." (Agassiz, 1979, p. 75) We note also that, being given in French and with the imperial presence, the lectures became a social event, with the participation of the elite of the city. The content of the lectures was exposed in Brazilian newspapers reaching a wider audience.

About local museum of natural history, Agassiz with his experience on constructing and directing a museum, had critical comments: "The Imperial Museum of Natural History in the Capital is antiquated; to any one acquainted with Museums which are living and progressive it is evident that the collections it contains have been allowed to remain for years in their present condition, without additions or improvements. The mounted animals, mammalia and birds, are faded; and the fishes, with the exception of a few beautifully stuffed specimens from the Amazons, give no idea of the variety to be found in the Brazilian waters. A better collection might be made any morning in the fish-market." (Agassiz, 1979, p. 501)

In his return of Amazon region, one year later, Agassiz gave in Rio de Janeiro six public lectures on the Amazon Valley. He had the explicit objective of disclosing the (supposed) confirmation of his ideas on the existence of a glacial period in that area. He presented also critical arguments against the natural selection. Curiously, the first public presentation in Brazil of the ideas of natural selection seems to have been done by one of its main opponents.

Elizabeth Agassiz made interesting comments on this new series of lectures analyzing the behavior of the Brazilian audience: "This week Mr. Agassiz has concluded another course of six lectures given at the College of Dom Pedro II; the subject, The Formation of the Amazon Valley, and its productions. It is worthy of remark, that the appearance of ladies on such occasions no longer excites comment. There were many senhoras among the listeners than at the previous lectures, when their presence was a novelty. A Brazilian audience is very sympathetic; in this they resemble a European assembly more than our own quiet, undemonstrative crowds. There is

always a little stir, a responsive thrill, when anything pleases them, and often a spoken word of commendation or criticism." (Agassiz, 1979, p. 501) The content of these lectures was also disclosed in the newspapers and were published in a small book (Agassiz, 1866).

IV. The popularization of knowledge in the inverse sense or the usually forgotten contribution of native people The contributions of native cultures of distant areas of Europe for the scientific knowledge acquired, built or created by the naturalists have nearly always been disregarded in history of science studies. The attentions have been addressed for the observations and theories developed by the scientists, for their formations, instruments and working methods, for the diffusion of their ideas and for the political, philosophical and economical influences on their scientific works. The local base that frequently was important for the good results of the field works. The local people is described usually as an illiterate and ignorant population. However it is from the local community that, in good measure, the success of several of those scientific expeditions will depend. Starting from the reports that we analyzed, we established the following main types of the local personnel's contributions for the naturalistic activity: identification, location of animals and plants; preparation and preservation of specimens; 'discovery' of 'new' species; analysis of habits and uses of animals and plants; geographical and meteorological knowledge; knowledge on the distributions of animals and plants; anthropological reports and of naturalistic observations; nomenclature of plants; indication of more favorable regions for the research activity; domestication of animals; production of instruments for capture and preservation of animal specimens.

Bates and Wallace's attitudes toward the native people has made possible the extraordinary success in their collection works. In its eleven years in the Amazon, Bates would pick up 14.712 different specimens (insects, in the great majority) of the which 8.000 were new for science. In his travel book, he mentioned about 135 people of the most several origins, that aided him in its task: of dealers and farmers to slaves and servants, of military and Indians guides and hunters. In his book, Wallace reports about hundred people that interacted with him and collaborated with his tasks. Several aspects of the native's contributions emerge from this account as: support in collecting animal specimens, location of trails, native knowledge on the geographical distribution of the animals and plants, help in constructing the Rio Negro map. The native knowledge of the plants and theirs uses was highlighted by Wallace, as in this passage in which he describes his learning with an old guide of the forest:

"The old guide [Isidoro]... had worked formerly at the forest, being in the know not only of the names of all the trees, as well as of its properties and uses. He was a man of almost taciturn temper, except when he was irritated with our incredible inability of understanding his explanations. (...) The fact is that he really liked to exhibit his knowledge on those subjects concerning which we still were in the apprenticeship stage or in the most complete, but whose learning we wanted indeed to reach. His teaching method consisted of a series of fast observations on the trees as while we were going in the midst of them." (Wallace, 1979, p. 231) It is interesting to note the Wallace's apprentice attitude before the old guide's methodology. We have here also an elucidative example of transmission of knowledge in the inverse direction to the usually considered.

In his voyage book, Agassiz emphasized frequently the great indigenous knowledge on Amazon flora and fauna and the importance of that knowledge for science. He proposed to the Emperor the creation of a commission for getting from the native peoples all the information and for organizing an encyclopedia of the indigenous knowledge: "A large number of the trees forming these forests are still unknown to science, and yet the Indians, those practical botanists and zoologists, are well acquainted, not only with their external appearance, but also with their various properties. So intimate is their practical knowledge of the natural objects about them, that I believe it would greatly contribute to the progress of science if a systematic record were made of all the information thus scattered through the land; an encyclopedia of the woods, as it were, taken down from the tribes which inhabit them think it would be no bad way of collecting, to go from settlement to settlement, sending the Indians out to gather all the plants they know, to dry and label them with the names applied to them in the locality, and writing out, under the heads of

these names, all that may thus be ascertained of their medicinal and otherwise useful properties, as well as their botanical character." (Agassiz, 1975, p. 209)

Spix and Martius had described the indigenous knowledge in a similar way: "They can distinguish the external parts and interiors of the body and the different animals and plants with great accuracy and, not rare, they indicate the relationship of things of the nature to each other. Thus, for example, the indigenous denomination of the several monkeys and of certain palm trees were for us a guide in the investigation of the species, because almost each species has an own indigenous name." (Spix and Martius, 1981, p. 236) We concluded with the main result we extracted from these readings. The naturalists' activity, in certain measure and in some circumstances, contributed to the diffusion of scientific knowledge in the regions they visited. Of course their voyage books had a significant impact on natural history popularization in their countries. On the other hand, when analyzing with more care their texts we can perceive the existence of an inverse process of transmitting knowledge and skills from the native people to the naturalists, that also deserves to be considered and analyzed.

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