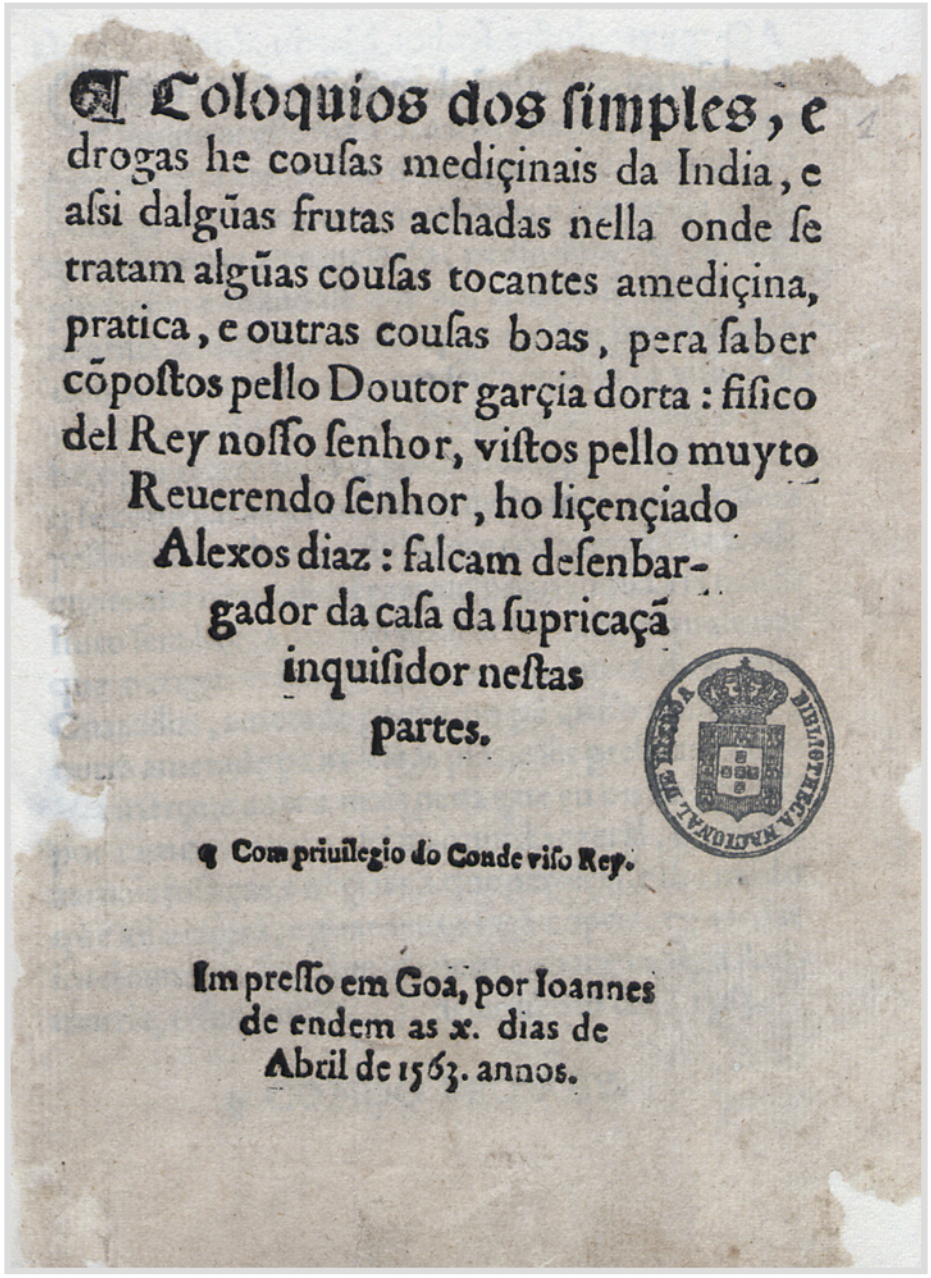
HOST
JOURNAL OF HISTORY OF SCIENCE AND TECHNOLOGY

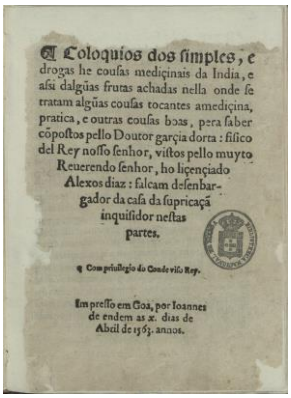
Vol. 8 | Fall 2013

Moving Localities



Journal of History of Science and Technology
ISSN 1646-7752
www.johost.eu

Cover



A Coloquios dos simples, e drogas he cousas mediçinais da India, e assi dalgũas frutas achadas nella onde se tratam algũas cousas tocantes amediçina, pratica, e outras cousas boas, pera saber cõpostos pello Doutor garçia dorta: fisico del Rey nosso senhor, vistos pello muyto Reuerendo senhor, ho liçençiado Alexos diaz: falcam desenbargador da casa da supricaçã inquisidor nestas partes.

¶ Com priuilegio do Conde visoRey.

Em presso em Goa, por Ioannes de endem as x. dias de Abril de 1563. annos.

Front cover of *Colloquies on the simples* (Goa, 1563) (BNP)

Journal of History of Science and Technology

Vol.8, Fall 2013

ISSN 1646-7752

www.johost.eu

Published by

Interuniversity Centre for the History of Science and Technology

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Introduction

Pedro M. P. Raposo[*]

Three historical characters feature in this issue of HoST. The first one is the Portuguese physician Garcia de Orta (ca. 1500–1568), who authored the treatise *Colóquios dos Simples e Drogas he Cousas Mediçinais da Índia* [*Colloquies on the simples & drugs of India*], a work of great originality that brought to Europe new knowledge about nature and its uses in Asia. The second is the Greek-speaking scholar Eugenios Voulgaris (1716–1806), a polymath who wrote influential treatises in metaphysics, logic, literature, theology, history, politics, and, last but not least, Newtonian physics, which he combined with neo-Aristotelian philosophy. The third is the Portuguese astronomer Frederico Augusto Oom (1830–1890), perhaps the most obscure of the three, but a man of science who was entrusted with an ambitious research programme in stellar astronomy, when this was but an incipient branch of astronomical science. Oom became an astronomer by chance, or better said, by force. And if Orta and Voulgaris affirmed their names as the authors of important treatises, it was not so much because they had primarily set out to be scholarly writers, but rather due to particular circumstances of their life-paths and careers. The three cases encompass complex geographical backdrops: in Orta's case, that of the emerging Portuguese seaborne empire; in Voulgaris', a wide tapestry of Orthodox communities and Greek-speaking networks that extended across not one, but three empires; and in Oom's, the circuits of nineteenth-century European astronomy, in which the major observatory in Russia (the Observatory of Pulkovo) constituted the utmost embodiment of the tenets of German astronomical practice.

Despite the different periods and contexts in which they unfolded, the lives and careers of these historical actors testify to the crucial role of mobility and displacement in the making of knowledge. Staying in Goa, Orta used a wide network of Portuguese-speaking informants to gather the material presented in the *Colóquios.* This network, as shown in Teresa Carvalho's paper, comprised people from various social strata, walks of life and occupations; it provided Orta with first-hand knowledge that he combined with his own background as a well-read European physician. Orta used the *Colóquios* to fashion himself as an authoritative harbinger of novelties from the East, although his treatise might be better regarded as the result of an encounter between different knowledge traditions. The Portuguese settlements in India, the

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power relations and administrative structures of which were efficiently used by Orta in the making of *Colóquios*, provided a suitable framework for the combination of local knowledge with European science, thus constituting a gateway for the emergence of a new Western discourse about nature in Asia.

The close relations between epistemic pursuits, empire and trade, which were by no means unusual in the early modern world (and thereafter), are well illustrated by *Colóquios.* In fact, it is not only a treatise of natural history, medicine and pharmacology, but also a work that reflects the efforts of the Portuguese crown to regulate the drug trade in India, and more generally to consolidate its presence and influence in the area, whilst seeking to take full advantage of its economic potential. We must bear in mind that Orta himself was, very likely, a merchant too. This aspect is emphasized in the second article of this issue, in which Rui Loureiro, by focusing on how precious stones are addressed in *Colóquios*, shows that scholarly debates on the use of precious stones for medical purposes were not strange to personnel involvement in trading activities, and that issues of knowledge and truth were not necessarily detached from matters of economic value. The mediation between different knowledge traditions thus developed in tandem with the mediation between political and economic interests.

Different motivations were at play in the case of Eugenios Voulgaris, which is addressed by Manolis Pationiotis. Patiniotis employs the category of "go-between"[1] to present Voulgaris as a seeker of intellectual prestige in the context of the wide and diverse cultural space of eighteenth-century Orthodoxy. Voulgaris used his abilities as a translator to combine the new findings of modern empiricism with the neo-Aristotelian worldview that lay at the core of humanistic education in the Greek-speaking world. Here, translation was not a straightforward process of transferring someone else's words into another language, but rather a creative form of mediation that produced new discourses. Carvalho's and Loureiros' papers depict Orta acting as an expert-in-chief, using his authority to validate knowledge provided by the many go-betweens who, one way or another, had an input in *Colóquios*. In Patiniotis' paper, the go-between comes to the fore as a protagonist whose role goes beyond that of an agent of cross-cultural diffusion. A prominent member of a generation of scholars who claimed social power on the basis of intellectual skill, Voulgaris sought to establish bridges between disparate cultural traditions and different strands of intellectual inquiry. His case shows that a go-between could

[1] See introduction to: Simon Schaffer, Lissa Roberts, Kapil Raj, James Delbourgo (eds.), *The Brokered World: Go-Betweens and Global Intelligence, 1770-1820* (Sagamore Beach: Science History Publications, 2009).

be, more than a broker, someone who acted as an active agent of intellectual production by developing such bridges.

Having lived and worked in a time when disciplinary boundaries were sharpening, F. A. Oom's life path, strongly tied to a specific institutional project – the Astronomical Observatory of Lisbon, founded in the late 1850s – illustrates the interplay between the formation of the scientific persona of the astronomer, the materiality of astronomical practice, and the importance of mobility and displacement in the construction of specific sites of knowledge. In 1858 the Portuguese government entrusted Oom with a twofold mission that consisted of an apprenticeship at the Pulkovo Observatory in Russia, and of a fact-finding tour of other observatories and instrument workshops. The goal of the mission was to prepare Oom to lead the future Astronomical Observatory of Lisbon, which was expected to further investigations in stellar astronomy carried out at Pulkovo. Both the astronomer and the observatory were formed through this mission, which developed along the same circuits on which Pulkovo was grounded. Although deeply inscribed in the cultural and political tenets of Tsarist Russia, the Pulkovo Observatory constituted, above all, a well-crafted synthesis of astronomical practices and paraphernalia valued by prominent practitioners in the German lands. By travelling these circuits whilst striving to become a fully-fledged astronomer, Oom played a crucial role in mediating between Portuguese aspirations towards cultural sophistication, the desire of Pulkovo's astronomers to secure the international leadership in stellar astronomy, and the German instrument makers' drive to hold the flag of technical prowess and innovation. The Observatory of Lisbon thus came to embody not just a reworked and rescaled version of Pulkovo, but actually a wide array of interactions that developed over an extensive geographical area.

Despite the different characters, pursuits and historical contexts addressed in the four papers, there are three common caveats that must be emphasized. The first is that we may gain from following "peripheral" and secondary actors who would hardly feature in narratives of science tied to a rigid centre-periphery divide, in which the "locality" of knowledge is coupled to a clear spatial arrangement of sites of knowledge production, as opposed to sites of knowledge reception and appropriation.[2] Orta, Voulgaris and Oom undertook the production of new

[2] For a reappraisal of the concept of appropriation in the context of the STEP – Science and Technology in the European Peripheries see: Kostas Gavroglu, Manolis Patiniotis, Faidra Papanelopoulou, Ana Simões, Ana Carneiro, Maria Paula Diogo, José Ramón Bertomeu Sánchez, Antonio García Belmar, Agustí Nieto-Galan, "Science and Technology in the European Periphery: Some historiographical reflections", *History of Science*, 2008, xlvi: 153-175, and also Kostas Gavroglu, "The STEP (Science and Technology in the European Periphery) Initiative: Attempting to Historicize the Notion of European Science", *Centaurus*, 54, 2012: 311-327.

knowledge not so much by sitting in privileged centres of production, but mainly by performing a mediating action between knowledge traditions, actors, interests and pursuits interconnected through various spaces.

This leads us to the second caveat: that a notion of "locality" tied to a rigid concept of "location" must be discarded, or at least taken cautiously.[3] Orta, Voulgaris and Oom were neither parochial, nor detached from their spaces of origin. Ultimately, it was their ability to combine their backgrounds (which they never withdrew) with new findings (which they did not approach passively) that ultimately empowered their intellectual and scientific endeavours.

The final caveat, which follows from the preceding two, is that, instead of approaching circulation as the movement of "immutable mobiles"[4] or as the displacement and appropriation of ready-made knowledge, we should take a step further and think about circulation in terms of knowledge production.[5] This requires a shift of focus from the places where knowledge is produced and (re)located, to the ways it evolves through moving localities.[6]

The present issue of HoST will certainly provide food for thought to those willing to further pursue these lines.

[3] This idea is akin to Apaddurai's suggestion to replace 'trait' geographies with 'process' geographies. See Arjun Appadurai (ed.), *Globalization* (Durham and London: Duke University Press, 2001), pp. 7-8, and also the discussion in Manolis Patiniotis contribution to this issue.

[4] See Bruno Latour, *Science in Action: How to Follow Scientists and Engineers Through Society* (Harvard University Press, 1987), esp. Ch. 6, 'Centres of Calculation'.

[5] This idea is already present, albeit somewhat understated, in works such as the following: Kapil Raj, "Beyond Postcolonialism …and Postpositivism: Circulation and the Global History of Science", *Isis*, 2013, 104: 337-347; *Relocating modern science: circulation and the construction of knowledge in South Asia and Europe 1650–1900* (Hampshire: Palgrave Macmillan, 2007); James Secord, "Knowledge in transit", *Isis,* 95, 2004: 654–672.

[6] For a further historiographic discussion see: Pedro M. P. Raposo, Ana Simões, Manolis Patiniotis, José Bertomeu-Sanchez, 'Moving Localities and Creative Circulation: Travels as knowledge production in 18th century Europe', *Centaurus.* DOI: 10.1111/1600-0498.12066.

Local knowledge in Portuguese words: Oral and manuscript sources of the *Colloquies on the simples* by Garcia de Orta

Teresa Nobre de Carvalho[*]

ABSTRACT

Published in Goa in 1563, the work of Garcia de Orta (ca. 1500–1568), *Colóquios dos Simples e Drogas he Cousas Mediçinais da Índia* [*Colloquies on the simples & drugs of India*], revealed the impressive scholarship of its author. His academic training in Castilian universities and an important library gave him a solid medical and botanical knowledge supported by a vast specialised literature. Nevertheless, in his search for novelties about nature in Asia, Orta did not dispense with the contribution of local informants and royal officials, who by travelling through the innermost recesses of the East collected news and novelties of Asia's natural resources. The participation of these agents from very different social and cultural strata in the reconfiguration of knowledge about the Asian natural world was one of the most original contributions of Orta to European science. This paper focuses on Orta's Portuguese sources with emphasis on some of the oral testimonies and manuscript reports that travellers and royal officials collected during their journeys in Asia. These, having being tested and validated by Orta became the foundation of a new truth about the natural world of the East described in his *Colloquies on the simples*.

Keywords: Garcia de Orta, *Colóquios dos Simples*, Orta's Portuguese sources, knowledge circulation

The diffusion of novelties

Until 1515, that is, during the first decade of the Portuguese presence in the East, the collection of information about the Asian natural world was fragmentary and revealed a poorly

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organised exploration. The testimonies of travellers, soldiers and adventurers who landed in Lisbon coming from the East and the letters sent to the Crown by royal officials posted in Asia were the main source of news about Indian nature, in the beginning of the sixteenth century.

Tome Pires (ca 1465–ca 1540) and Duarte Barbosa (ca 1480–1521) marked a turning point in the observation of the Asian natural world. The former sailed to the East in 1511 with a mission to identify and select drugs that should be sent back to the Portuguese kingdom. Druggist by profession, in 1515, Pires completed the *Suma Oriental*, considered the first modern geography of the East, where he collected information on Asian nature provided by local informants.[1] Due to the relevance of this work, he was appointed to head the first Portuguese diplomatic mission to Beijing.

Also at the beginning of the sixteenth century, Duarte Barbosa went to Asia where he lived most of his life. He was for a long period a scrivener in the Cannanore factory. Living in that area, he was able to learn Malayalam, the language spoken in this region of India by every merchant, and proved to be a skilled tradesman. He wrote an extensive and detailed report, *O Livro de Duarte Barbosa* (1516), which had a wide distribution as shown by the different manuscript versions known today. In this report, which resulted from his observations and contacts with local traditions and manuscript sources, Barbosa provided a detailed description of Eastern kingdoms, cities, ports, people, wealth and natural resources.[2]

Therefore, during their stay in the East, both men wrote detailed accounts of nature based on their observations and on testimonies provided by reliable local informants. Through the work of these two authors, the Portuguese kingdom was informed of the regional outline of the East, its ports and markets, its people, the eating habits of its societies and its wealth of natural resources. The work of the two Portuguese men shed light on a part of the world hitherto unknown in the West.

In addition to frequent geographical, political and economic reports, they made reference to a huge variety of tropical fruits and peculiar exotic plants, and included the necessary descriptions of spices and drugs. Palm trees, pepper, cinnamon, lacquer, benzoin,

[1] Part of this text was published by G. B. Ramusio, who included it in his book *Delle Navigationni et Viaggi*, Venice, Giunti, 1550. For more information on the work of Pires, see: *A Suma Oriental de Tomé Pires*, ed. Armando Cortesão, and its English version: *The Suma Oriental of Tomé Pires*, tr. and annot. A. Cortesão, London, The Hakluyt Society, 1944, in addition to the recent critical edition, *O manuscrito de Lisboa da "Suma Oriental" de Tomé Pires*, critical ed. Rui Manuel Loureiro, Macau, Instituto Português do Oriente, 1996.

[2] The news he reported were widely disseminated through the referred Ramusio's collection, D*elle Navigationni et Viaggi*. Barbosa's work has several Portuguese editions, namely: Duarte Barbosa, *Livro do que viu e ouviu no Oriente*, ed. Luis de Albuquerque, Lisbon, ALFA, 1989; Duarte Barbosa, *O Livro de Duarte Barbosa*, ed. Maria Augusta da Veiga e Sousa, 2 vols. Lisbon, IICT, 1996-2000. For an English version, see: *The Book of Duarte Barbosa*, translation and notes M. L. Dames, London, The Hakluyt Society, 1918-1921.

nutmeg, cloves or camphor were some of the products that gained Barbosa's attention. The pragmatic clerk attached to his book an appendix recording data about the origin and price of the main spices —pepper, cloves, cinnamon, ginger—and noted the prices of the most important drugs in the Calicut market—tincal, camphor, agarwood, linaloes, musk, benzoin, tamarinds, calamus, myrrh, incense, amber, cassia, sandalwood, nutmeg, spikenard, mace, indigo, zedoary, zerumbet, cardamom, rhubarb, tutty, cubeb, mirabolanos or opium.

Tome Pires, in turn, filled the folios of his *Suma Oriental* with information on the origin, quality and value of many Asian products. In his report he collected information on: pearls, musk, aloes, amber, indigo, areca, sulphur, benzoin, betel nut, camphor, cinnamon, coconut, copra, cloves, folio indo, ginger, sesame, jackfruit, jangomas, lac, aloewood, mace, mangoes, mirabolanos, nutmeg, opium, alum, pepper, rhubarb, sandalwood, dragon's blood, tutty, tamarind, and cinnabar..

Later confirmed and validated by Orta's inquires, observations and medical experience, much of the information collected by these royal officials was included in Garcia de Orta's work.

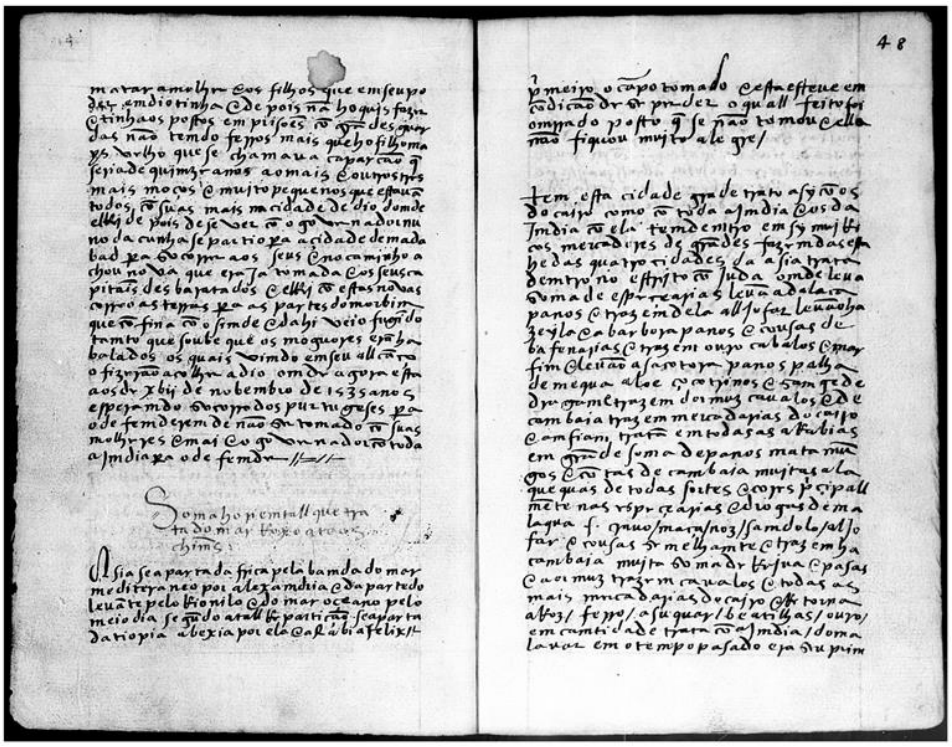


Figure 1 - The *Suma Oriental* of Tome Pires (BNP – National Public Library).

In a letter Tome Pires sent in January 1516 to King Manuel (reigned 1495–1521), he identified the regions of origin, the local customs and the main markets where oriental products

were traded. Pires did not overlook drugs used in the Portuguese pharmacopoeia such as: rhubarb, incense, opium, tamarinds, galangal, mirabolanos, aloes, spikenard, asafoetida, bdellium, myrrh, betel nut, zedoary, rubies or pearls, among others.[3]

Through the reports and letters of royal officials, the Portuguese elites were becoming aware of the geographical origin, the distribution routes and the therapeutic qualities of the natural resources of the East. Curious travellers, sailors and merchants thus became the vehicle of an innovative speech about the world as they saw it. Confirmed by eyewitnesses, these reports spread in Europe a new kind of description of nature that dispensed with texts and was based on first-hand experience.[4]

Regulation of the drug trade in the East

In order to maintain the Portuguese presence in the East, forts were built and trading posts (factories) were established at strategic points. With a view to ensuring the health of soldiers and royal officials, the Portuguese Crown invested in building a network of hospitals. All these entities were served by apothecaries who provided drugs and products essential to preserving the health of the seconded officials. Note that, at the time, the term "apothecary" had a much broader sense than it has today. In addition to medicines and drugs, they provided soap and opium, as well as supplies for the city, as shown in the documents of Goa's Customs.[5]

Aware of the huge amount of drugs in circulation and of the serious inconvenience caused by setting up apothecaries without royal control, King Manuel imposed the regulation and inspection of their activities. This evaluation was not limited to the technical staff. Products for sale also underwent careful analysis. If the quality of the medicines examined did not meet the inspectors' criteria, regulations provided for heavy fines for the owner and the public burning of the products in question.

The sovereign also required apothecaries in the cities, towns and villages under his rule to abide scrupulously by the prices set for medicines and drugs. The "Regimento de Preços de 1497" [Price Regulation of 1497] was in force throughout his reign and it was only officially

[3] "Carta de Tomé Pires", in Armando Cortesão, 1978. *A Suma Oriental de Tomé Pires e o Livro de Francisco Rodrigues*, pp. 445-459.

[4] It is interesting to note that in the South American Continent there was a similar movement to collect reports about the natural resources. For further examples, see: José Pardo Tomas, Maria Luz Lopez Terrada, *Las primeras noticias sobre plantas americanas en las relaciones de viajes y crónicas de Indias* (1493-1553), Valencia, CSIC, 1993, 364 pps.

[5] Vasconcellos e Menezes, J., *Armadas Portuguesas. Apoio sanitário na época dos Descobrimentos. Parte II: Boticas e Boticários de Além-mar*, Lisboa, Academia de Marinha, 1987, p.113.

amended by order of Martim Afonso de Sousa (1500–1572).[6] De Sousa travelled to the East where he held several government posts, namely captain-major of the fleet (1534–1538) and governor (1542–1545). As governor, he played an important role in the development and organisation of the Royal Hospital in Goa. Apparently concerned about the trade in drugs and medicines, he ordered the then overseer, Fernão Rodrigues de Castelo Branco, to establish a "Pauta das Mezinhas" [Tariff of Medicines], where the price of drugs was set to be abided by in the whole kingdom and in most of the "Estado da Índia". The 1542 *Tariff*, which redesigned former rules, remained in force until 1573.[7]

This list of spices, medicines and therapeutic formulas, and their purchase and sale prices, prevailed in the eastern hospitals and apothecaries for thirty years. During the rule of D. Constantino de Bragança (Viceroy 1558–1561), the prices of some drugs were reviewed and updated, while the rest of the list remained unchanged.[8] According to the introductory note to the 1573 "Pauta das Mezinhas", some officials had brought to the attention of Dom Constantino the disparity between regulated prices and actual prices, leading the governor to update some of them. They remained valid until 1573, when the team of physicians and apothecaries led by surgeon-general Duarte Lopes updated it again.

Thus, price regulation for drugs and medicines depended on technical advice from apothecaries, physicians and officials who together calculated the new price. Only in 1572, did apothecary Baltazar Rodrigues asked D. Antão de Noronha (Viceroy 1571-1573) to allow the complete review of the "Pauta" then effective, with the corresponding price update. Having immediately complied with this suggestion, the governor instructed Luis Freire de Andrade to appoint a committee that would carry out the task quickly and effectively. The new "Pauta das Mezinhas" was approved in April 1573 and the price list for the purchase and sale of medicines in all hospitals, fleets and fortresses in Portuguese India immediately entered into force. This "Pauta" lasted until the late sixteenth century, when the health policy imposed by King Philip II of Spain, who also ruled Portugal as Philip I from 1581 to 1598, led to new approaches that are beyond the scope of this paper.

[6] For further information on this aristocrat, see Luís de Albuquerque, *Martim Afonso de Sousa*, Lisbon, ALFA Editions, 1989, and Alexandra Pelúcia,-*Martim Afonso de Sousa e a sua linhagem: trajectórias de uma elite no império de D. João III e D. Sebastião*, Lisboa, CHAM, 2009.

[7] Tello da Fonseca, *História da farmácia portuguesa através da sua legislação*, Porto, Emp. Ind. Gráfica do Porto, vol. 3, pp. 12–21.

[8] Pedro José da Silva, *Jornal de Pharmacia e Sciencias Medicas da India Portugueza,* 1868, pp. 88 – 93.

The Elvas Codex: a collection of individual reports

Perhaps due to a greater stability in the administration or to a more favourable political situation, it seems that it was under the rule of Martim Afonso de Sousa (Governor 1542–1545) or D. João de Castro (Viceroy 1545–1548) that overseers, factors and apothecaries living in the East were requested to systematically provide reliable information on Asia's main natural resources. Some of these officials promptly responded to this request and the data they provided was integrated into what is now known as the *Elvas Codex*. Identified by Domingos e Lavadinho as *Livro que trata das cousas da Índia e do Japão* (*Book about things from India and Japan*), the book had a critical edition in the twentieth century by Adelino Almeida Calado.[9] As shown in the handwritten dedication, this collection was offered in 1901 to Antonio Thomaz Pires by Francisco de Paula Santa Clara and, since 1913, it has been part of the collection of manuscripts of the Elvas Public Library. Thomaz Pires died in 1913 and, according to Almeida Calado, his private library was then donated to the City Library.[10]

The manuscript has the provisional book number 5/381 and consists of 101 sheets, about a dozen of which were left blank. It consists of two types of paper that Almeida Calado was able to date to the mid-sixteenth century. Bound with "a large sheet of parchment, undoubtedly torn out from a missal, of which are still left staves, musical notes and verses in brown with green capital letters,"[11] Although there are no notes about their sixteenth-century owners, there are in the Codex multiple direct evidence and indirect indications that allow it to be dated with certainty to 1546 –1548.

The volume collects twenty-five reports produced in the East by local prominent agents. Since some of the reporters signed their reports, the authorship of part of these texts is indisputable. Apparently, information was collected and recorded by informants selected for their professional integrity and obvious technical skills. Thus, in order to identify the region of origin of the drugs, they used the experience of the chief apothecary of D. João de Castro, Simão Alvares[12]; to describe the supplies that arrived in Goa they asked for the knowledge of

[9] Domingos e Lavadinho, *Manuscritos e outros documentos da Biblioteca Municipal de Elvas,* 2 vol. 1945 –1948; Adelino Almeida Calado, "Livro que trata das cousas da Índia e do Japão", *Boletim da Biblioteca da Universidade de Coimbra,* Coimbra, Vol. XXIV, 1960, pp.1–138.

[10] For further information on António Thomaz Pires, see Alberto Iria, "Dos biógrafos portugueses de Garcia de Orta (nótulas bio-bibliográficas)", *Garcia de Orta*, vol. 11, nº4, 1963, pp.833 –856.

[11] Adelino Almeida Calado, "Livro que trata das cousas da India e do Japao", p.3.

[12] Simao Alvares, who when he wrote the report had been serving in the East as an apothecary for thirty-nine years, signed the information on the "nacymento of todolas droguas que vão pera o Reyno" (origin of all drugs going to the kingdom). In the "Enformação que me deu Symão Allvarez" [Information provided to me by Symão Allvarez], the apothecary presented his interlocutor a list of Asian products used in medicine. For each "simple", such as camphor, galangal, linaloes, cubeb,

the overseer and treasurer, Rui Goncalves de Caminha[13]; to talk about the Cochin rivers they asked the chief pilot of Cochim, Nicolau Goncalves[14]; to gather information about Ceylon or Hormuz, they used the experience of their factors, namely Antonio Pessoa[15] and Bastião Lopes Lobato[16]; to disseminate information about Persia, they resorted to the knowledge of the secretary of the Governor, Khwaja Pir Quli (Coje Percolim)[17].

sandalwood, peppers, cashew, cardamoms, canafistola, mirabolanos, aloes, incense, asafoetida, rhubarb, spikenard, costo, opium, myrrh or bdellium, Alvares identified the regions of origin of the best quality products. For further details, see: Jaime Walter, "Simão Álvares e o seu rol das drogas da Índia," *Studia,* Lisboa, 10, 1962, p.117–149, and Adelino Almeida Calado, "Livro que trata das cousas da Índia e do Japão," pp.50 –57. For more information on this apothecary, see: *Obras Completas de D. João de Castro*, Luís de Albuquerque e Armando Cortesão (eds.), Coimbra, Academia Internacional da Cultura Portuguesa, 1982.vol. 4, p.41 and pp.80–81.

[13] According to Schurhammer, Rui Goncalves de Caminha, "was one of the most influential citizens of Goa and was held in the highest repute throughout the land, even by the pagan and Mohammedan merchants and princes. […] He had also had been able to win the favor of the governors with his money, gifts and business acumen." Georg Schurhammer S.J. *Francis Xavier. His life, his times.* Vol II: India (1541 –1545), translated by M. Joseph Costelloe S.J. Rome, The Jesuit Historical Institute, 1977, p. 173. Overseer, trusted by Governor Joao de Castro, he wrote a report where he informed his "Lordship" about "the origin of the supplies arriving in Goa, which, contrary to what many say, are not all from Balaghat." Adelino Almeida Calado, "Livro que trata das cousas da Índia e do Japão," pp.62-67.

[14] Nicolau Goncalves signed a detailed report that identified some local rulers and informed of "the names of the rivers north of Cochin, from where timber comes to Cochin..." Adelino Almeida Calado, "Livro que trata das cousas da Índia e do Japão," pp.43-48. This official acted as chief master and chief pilot of Cochin and participated in the second siege of Diu. For some biographical notes, see: *Obras Completas de D. João de Castro*, vol. 4, p.112.

[15] Antonio Pessoa sailed to India for the first time in 1515, and he was in the Moluccas in 1524, in Malabar in 1525, in Diu from 1530 to 1531, as factor of Vasai in 1539, as factor and mayor of Ceylon in 1541-43. After fighting in Diu during the second siege, participating in the reconstruction of the fortress, he was sent to Bengal and the Moluccas in 1547 and returned to Ceylon in 1551. As factor of Ceylon, he signed the "Enformação das cousas do Ceylão" [Information on the things of Ceylon], which is included in the *Elvas Codex*. In this report, he gives a detailed description of the many riches of the island, with particular emphasis on cinnamon (Adelino Almeida Calado, "Livro que trata das cousas da Índia e do Japão," p.36 –39). By order of the Governor João de Castro, in 1545 he was paid the salaries owed by his previous stays in India and in 1546 he was given a prize of 50 *pardaus* for having wintered in Diu. João de Castro had a deep admiration for Antonio Pessoa. In the text written on 22 October 1548 by the priests who attended the governor in his last moments, he justified to King Joao III the offer made to the factor, on behalf of the sovereign, of some villages in Vasai with Pessoa's mighty deeds in the fleet sent to Diu. For more information on Antonio Pessoa, see: *Obras Completas de D. Joao de Castro*, vol. 4, p.129, or Banha de Andrade, A. "Drogas do Oriente", *Arquivo do Centro Cultural Português*, Paris, vol. 3, 1971, p.183. See also Georg Schurhammer S.J. *Francis Xavier - His life, his times*, vol. II: India (1541 –1545), p.279.

[16] Bastiao Lopes Lobato was factor of Hormuz between 1545 and 1547, when he was appointed Mayor of Goa. In the *Elvas Codex*, this factor of the Hormuz fortress provides detailed reports called "Enformação do enxofre que vem de dentro do estreyto de Ormuz, dada per Bastião Lopes Lobato, feytor que foy na dita cydade e fortaleza" ["Information about the sulphur that comes from the strait of Ormuz, given by Bastiao Lopes Lobato, factor of the said city and fortress"] and "Enformação do rendimento da cidade e reino dUrmuz, dada per Bastyão Lopes Lobato, feitor que foy na dita terra" ["Information about the income of the city and kingdom of Ormuz, given by Bastiao Lopes Lobato, factor of the said city"]. Adelino de Almeida Calado, "Livro que trata das cousas da India e do Japão," pp.117–120 and pp.128-130. See also Georg Schurhammer S.J., *Francis Xavier. Obras Completas de D. Joao de Castro, vol.3, p.117. His life, his times*, vol. II: India (1541–1545), p.395.

[17] According to Luis Filipe Thomaz, Coje Percolim did not enjoy the same favourable reputation with Governor Joao de Castro that he had had with his predecessors, namely Martim Afonso de Sousa. However, during Castro's rule, Percolim translated in 1547 a letter to the Sultan of Bijapur and in 1548 a treaty with Bijapur's Adil Shahi. The brief description of Persia included in the *Elvas Codex* was, according to Luis Filipe Thomaz, the last document written by Coje Percolim, before disappearing from the Portuguese political scene in the East. See: Luis Filipe Thomaz, "Hwaje Pir Qoli et sa brève relation de la Perse", *Eurasian Studies,* V.1/2, 2006, pp.357-369. The "Enformação de algumas cousas da pérsia" [Information about some things of Persia] is in Adelino de Almeida Calado, "Livro que trata das cousas da India e do Japão," pp.132-133.

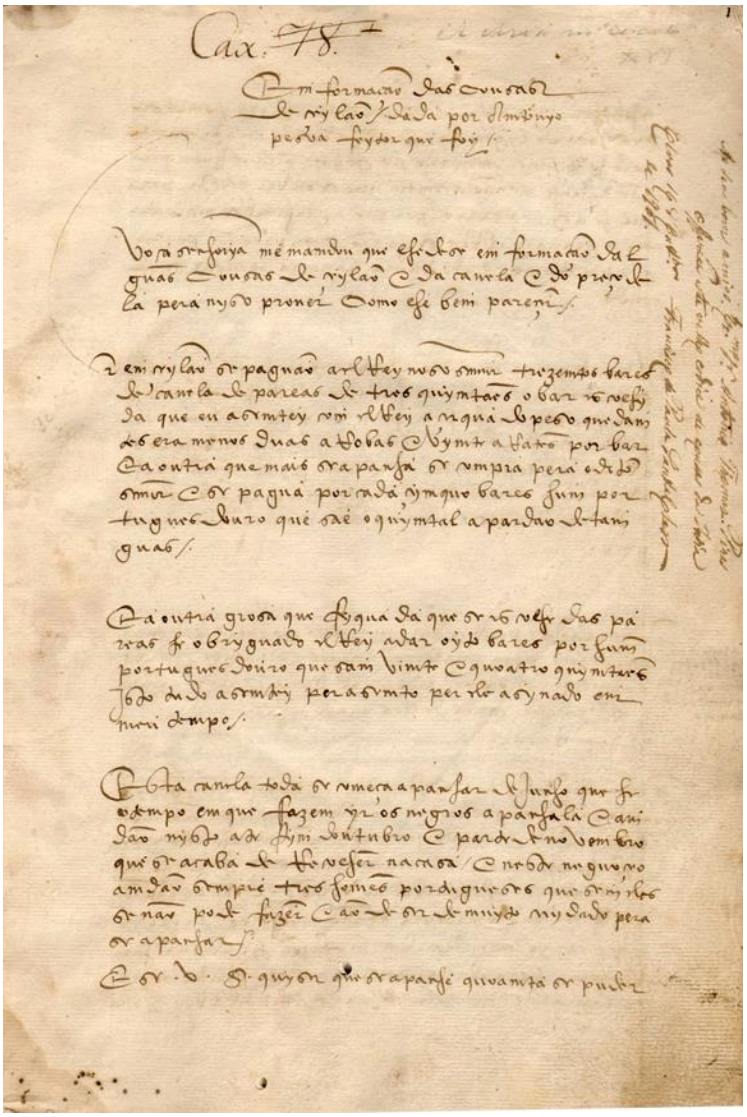


Figure 2 - The *Elvas Codex* (BPME – Elvas Public Library)

Topics range from listings of goods and natural resources to the identification of routes and markets, and the description of the origin of certain drugs and spices, as well as ground-breaking news about China and Japan.[18]

Each of the texts included in the collection seems to respond to pre-established questionnaires, thus revealing the targeted nature of the information collected. This method of gathering news about the Indies' natural resources would be years later repeated in the New World.[19]

[18] The Codex collects some of the first reports about the Far East such as the "Enformação da Ilha do Japão dada por mestre francysquo…" [Information about the island of Japan given by master Francisco...], "Mais emformação das cousas do Japão" [More information about things from Japan], "Enformação da Chyna" ["Information about China"] and "Mais enformação do Japão…" [More Information about Japan]. See: Adelino de Almeida Calado, "Livro que trata das cousas da India e do Japão," pp.88–117 and pp.121–125.

[19] Cf. *Relaciones Geograficas*. With these surveys, the Spanish Crown sought to make an inventory of resources, describe landscapes, characterise populations and collect native knowledge. For further information, see: Raquel Alvarez-Pelaez, *La*

Besides contributing to provide a clearer geographical outline of the East, these summaries, reports and lists of drugs seem also to have been important for strategic decision-making. While the analysis of the impact of this information is still to be completed, these documents reveal the interest of Portuguese rulers in the East in making an inventory of the natural resources and commercial potential of each region.[20]

Whereas Tome Pires and Duarte Barbosa directed their reports primarily to the government in Lisbon, Antonio Pessoa, Nicolau Goncalves, Simao Alvares, Joao de Magalhaes, Mestre Pedro, Rui Goncalves de Caminha, Francisco Pereira, Alvaro de Sousa, Coje Percolim, among others who signed the reports collected in the *Elvas Codex*, addressed a Portuguese authority in Goa, perhaps Martim Afonso de Sousa or Joao de Castro. As we will show below, Garcia de Orta had access to this classified information and used it in writing the *Colloquies on the simples*. The authors of these documents can thus be identified with some of the "Portugueses dignos de fé" [Portuguese of credit] to whom Garcia de Orta refers to in his text.[21]

On the death of Governor Joao de Castro, Garcia de Sá, governor from 1548 to 1549, continued this project of gathering news. Almeida Calado gives credit to the Governor for the compilation of reports written by Portuguese officials.[22]

At the time, the absence of printing in the East hindered the wide dissemination of duly authorised news. Besides manuscripts, only oral testimonies could fill the gap of information on natural resources. In addition, the expansion into the Far East, China and Japan, was occurring at an intense pace and it was crucial to standardise information and prices of local products throughout the area where the Portuguese then freely moved.

Publishing a book on India's drugs and medicines became an increasing priority as it could enable not only market regulation and stability of distribution routes, and the establishment of strategic resource exploitation priorities, but also the standardisation of health

conquista de la naturaleza americana, Valencia, CSIC, 1993, pp.141-318; Antonio Barrera-Osorio, *Experiencing Nature. The Spanish American Empire and the Early Scientific Revolution,* Austin, University of Texas Press, 2006, pp.56–100; Barbara Mundy, *The mapping of New Spain: Indigenous cartography and the maps of the Relaciones Geograficas,* Chicago, University of Chicago Press, 2000, pp.29–60 or David N. Livingstone, *Putting science in its place. Geographies of Scientific knowledge,* Chicago, Chicago University Press, 2003, pp.99–134.

[20] For a broader view on the diversity of testimonies that provided information about the natural world in the East, see the work of Luis de Pina, "As ciências na História do império colonial português (séculos XV a XIX)", excerpt of the vols. 1937–1945 of the *Anais da Faculdade de Ciências do Porto*, Porto, Imprensa Portuguesa, 1945, and Donald Lach, *Asia in the making of Europe*, Chicago, University of Chicago Press, 1965, vol. 2, 1970.

[21] For further information on this topic, see: Rui Manuel Loureiro, *Animais Orientais: Fauna Exótica do tempo dos Descobrimentos*, Lagos, Câmara Municipal de Lagos, 2008, p.58, and Teresa Nobre de Carvalho, "Invisible travellers and virtual tracks: knowledge construction in *Colóquios dos simples e Drogas da Índia* of Garcia de Orta (Goa, 1563)" *Proceedings of the 4th ESHS Conference*, Barcelona, 2010, pp.288–293.

[22] Adelino Almeida Calado, "Livro que trata das cousas da India e do Japao", pp.1–35.

practices in the various hospitals of the cities and fortresses that the Portuguese were building in the East. In fact, the specificity of the diseases and the new drugs available made many physicians recently arrived from Portugal unable to effectively lead hospital teams effectively. Physicians who accompanied governors and viceroys remained in the East for little more than three years. This period was clearly insufficient to make them aware of the complexity of the therapeutic properties of Asian medicines. The inability of these "seasonal" physicians to cure tropical diseases was so harshly criticised that, in 1607, they were banned by royal charter from directing medical practice in Goa's Royal Hospital during the few years that their missions lasted.[23] Despite the concern of druggists, overseers, physicians and merchants, the long-awaited text only emerged in 1563 with the Goan edition of the *Colloquies on the simples*.[24]

Colloquies on the simples by Garcia de Orta

Born in Castelo de Vide, Garcia de Orta (*ca.* 1500–1568) did his medical studies in the Castilian universities of Salamanca and Alcalá de Henares. He taught for a short period in the *Escolas Gerais* in Lisbon, having sailed to India in 1534 as personal physician of Martim Afonso de Sousa, then captain-major of the fleet.

He would never return to Europe. Aware of his discreet place in contemporary Portuguese chronicles, Orta decided to reveal to his readers moments of his life in Asia and aspects of his personality. Therefore, the book often becomes autobiographical. To the eyes of his readers, Orta emerges as a man of sophisticated tastes, an experienced physician, a competent professional, an elegant conversationalist, a skilled manager of words. He describes himself, in short, as a wealthy physician living in Goa, the capital of the Portuguese 'Estado da India'. Textual references to a wide range of scientific works gave credit to his arguments.[25]

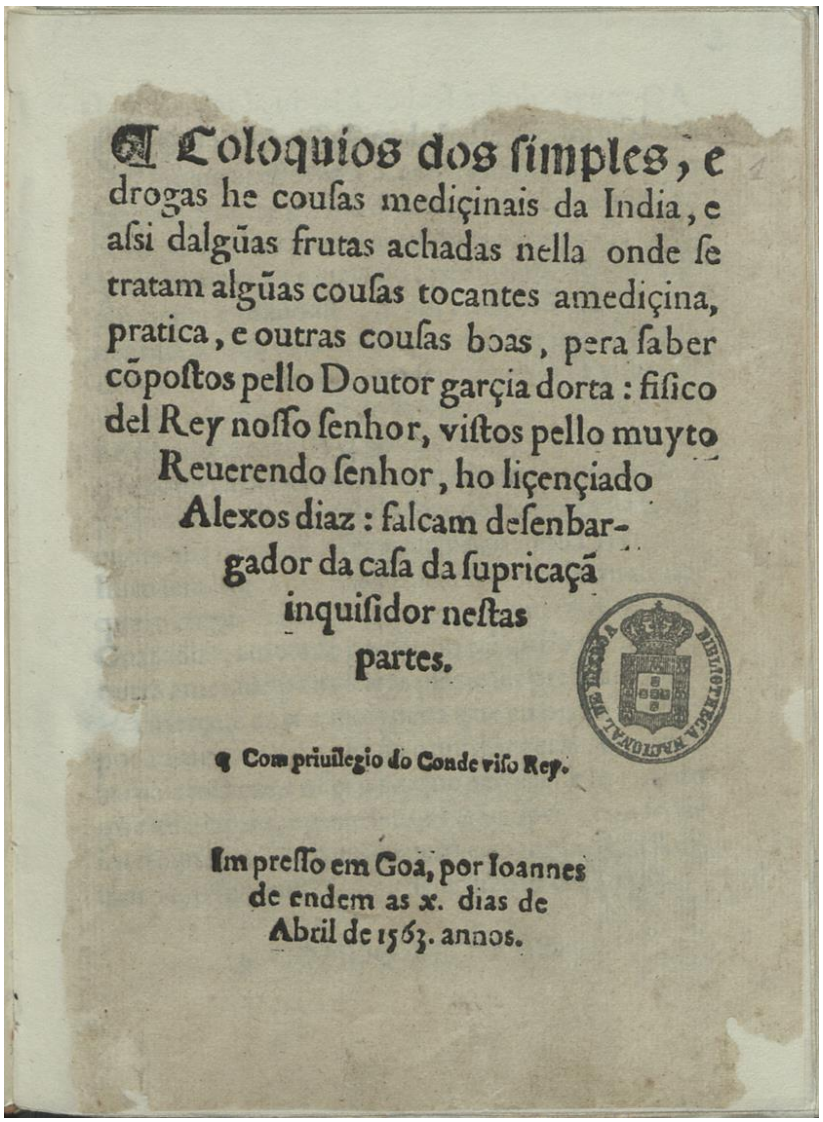
[23] Silva Carvalho, "Garcia d'Orta", *Revista da Universidade de Coimbra*, Coimbra, 12, 1934, p.158, note 1. For more information on the presence of Portuguese physicians who sailed East see also: Anibal de Castro, "Físicos, cirurgiões e boticários nas naus dos descobrimentos", *Arquipélago*, História, 2nd Series, 4, No. 2, 2000, pp.546 – 547.

[24] After the *editio princeps* published by the Goan workshop of Joao de Endem, the *Colloquies on the simples* was republished twice during the nineteenth century: the first time by Francisco Adolfo Varnhagen (1872) and the second time in two volumes by Ficalho, Imprensa Nacional, Lisbon (1891 – 1895). Text updating, extensive notes and scholarly comments made this third Portuguese edition the reference version of De Orta's work, used by the vast majority of scholars. In fact, it was based on this edition that Sir Clements Marckham published in 1913 his English version, *Colloquies on the Simples and Drugs of India*, and Sylvie Messinger-Ramos and Antonio Ramos coordinated the recent French version published by Actes Sud in 2004. This paper uses a recent version of Sir Clements Marckham's edition.

[25] Orta pictured himself as a scholar in his working office, supported by a vast library where he kept the most renowned medical and botanical works. For more information on Orta's library, see Conde de Ficalho, *Garcia de Orta e o seu tempo*, Lisbon, Imprensa Nacional, 1886, pp.280–298 and Rui Manuel Loureiro, "Garcia de Orta e *os Colóquios dos Simples*: Observações de um viajante sedentário." *Actas do Colóquios Internacional e Interdisciplinar Garcia de Orta e Alexander von Humboldt*, Lisbon, 2008, pp.135–145.

This description of his versatile and learned persona proved of the utmost importance since it would be the basis for his reliability as a witness of credit.

One of the novelties of this treatise devoted to the medical products of the East resulted from the valorisation of reports of numerous witnesses, which only his authority as a physician could accept or decline. Thus, the reader's trust in his judgment was crucial for the success of this editorial project.[26]


Colloquios dos ſimples, e drogas he couſas mediçinais da India, e aſsi dalgũas frutas achadas nella onde ſe tratam algũas couſas tocantes amediçina, pratica, e outras couſas boas, pera ſaber cõpoſtos pello Doutor garçia dorta: fiſico del Rey noſſo ſenhor, viſtos pello muyto Reuerendo ſenhor, ho liçençiado Alexos diaz: falcam deſenbargador da caſa da ſupricaçã inquiſidor neſtas partes.

Com priuilegio do Conde viſo Rey.

Impreſſo em Goa, por Ioannes de endem as x. dias de Abril de 1563. annos.

Figure 3 - Front cover of *Colloquies on the simples* (Goa, 1563) (BNP)

[26] Orta's authority was largely based on the trustworthy figure he created for himself. On Orta's self-representation, see: Teresa Nobre de Carvalho, *O mundo natural da Ásia aos olhos do Ocidente. Contribuição dos textos ibéricos quinhentistas para a construção de uma nova consciência europeia sobre a Ásia*, Ph.D. Thesis in History and Philosophy of Science, UL-FCUL, Lisbon, 2012 (photocopied document), pp.33–48.

The *Colloquies on the simples*, written in Portuguese and depicting the conversation between two Iberian physicians, provided the most updated knowledge on the main Oriental products, in alphabetical order. For each product, Garcia de Orta presented detailed data about its origin, use, prices, markets, distribution routes and therapeutic applications.[27] Useful both in Eastern hospitals and apothecaries of forts, valuable in ports and local markets, the work acquired not only great scientific and practical relevance, in Portugal and in Europe, but also an enormous strategic and commercial importance.[28]

Oral and manuscript sources in the *Colloquies on the simples*

In addition to the information contained in the above-mentioned texts of Duarte Barbosa or Tomé Pires, Orta used a wide range of informants whose participation the narrative he managed with great skill.[29]

Physicians of Cairo and Damascus[30], of Nizamoxa[31] and Sultan Bahadur; factors[32] and druggists[33]; employees and servants, or merchants[34] and lapidaries[35], they all passed on to Orta their knowledge about drugs and their applications, prices and markets of origin.

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[27] In addition to the work of Conde de Ficalho, *Garcia de Orta e o seu tempo*, Lisbon, Imprensa Nacional, 1886, which provides valuable assessments of the work of this physician, it seems useful at this point to mention some of the studies on Orta and his *Colloquies* that have recently been published in Portugal, namely: Gabriela Fragoso and Anabela Mendes (eds.) *Actas do Colóquio Internacional e Interdisciplinar Garcia de Orta e Alexander von Humboldt*, Lisboa, Portuguese Catholic University, 2008; Anabela Mendes (coord.) *Garcia de Orta and Alexander von Humboldt across the East and the West* [Proceedings of the International and Transdisciplinary Conference, Goa, 2009], Lisbon, Portuguese Catholic University, 2009; and Teresa Nobre de Carvalho, *O mundo natural da Ásia aos olhos do Ocidente.* Ph.D. Thesis, pp.23-346.

[28] See, for example, Harold J. Cook, *Matters of Exchange, Commerce, Medicine, and Science in the Dutch Golden Age*, London, Yale University Press, 2007, pp.93–104; M. A. Meadow, "Merchants and Marvels: Hans Jacob Fugger and the origins of the Wunderkammer" *in*: Pamela Smith and Paula Findlen (eds.) *Merchants and Marvels. Commerce, Science and Art in Early Modern Europe*, Routledge, New York, 2002, pp.182–200. On the relevance of the search for medical and botanical knowledge in the Iberian empires, see among others: Daniela Bleichmar, "Books, bodies and fields - Sixteenth-century transatlantic encounters with New World *materia medica*" *in*: Londa Schiebinger and Claudia Swan (eds.) *Colonial Botany - Science, commerce, and politics in the Early Modern World*, Pennsylvania, University of Pennsylvania Press, 2007, pp.83–99.

[29] Teresa Nobre de Carvalho, "Colóquios dos Simples de Garcia de Orta: Conversas no interior da Índia", *Actas do Colóquio Internacional e Interdisciplinar Garcia de Orta e Alexander von Humboldt*, Lisbon, 2008, p.165–174 and Rui Manuel Loureiro, "Garcia de Orta Garcia de Orta e os Colóquios dos simples: Observações de um viajante sedentário", *Actas do Colóquios Internacional e Interdisciplinar Garcia de Orta e Alexander von Humboldt*, Lisbon, 2008, pp.135–145.

[30] Orta, *Colloquies on the Simples and Drugs of India*, translated by Sir Clements Markham, Dehli, Sri Satguru Publications, 1987, p.205.

[31] Orta, *Colloquies on the Simples*, pp.310–312 and p.350.

[32] Orta, *Colloquies on the Simples*, pp.106–107 and p.365.

[33] Orta, *Colloquies on the Simples*, pp.373–374.

[34] Orta, *Colloquies on the Simples*, pp.432–433.

[35] Orta, *Colloquies on the Simples*, pp.345–347.

Every reader of the *Colloquies* had thus access to a wide range of data, which under the scrutiny of Garcia de Orta combined bookish knowledge, personal experiences and local traditions. Throughout the book's fifty-nine chapters, people from many different backgrounds and traditions interrupted the quiet conversations between the two physicians, filling the text with their knowledge and testimonies.

The information brought to him by "a factor of Ormuz" on the bezoar stone[36] or those "a factor from Maluco"[37] told him about cloves reveal his interaction with royal officials.

Information about the root of China provided by "a very honourable and rich man was cured who, being in Diu, told my master Martim Afonso de Sousa,[...] how he had been cured by the root of China, which restored him to complete health, not requiring any special diet" reflects his straightforward relationship with Portuguese noblemen.[38]

In the presence of a viceroy, his discussion on cardamoms with a druggist, who "was an old man who had been a long time in India" attests to his familiarity with the political power.[39]

The secrets entrusted to his readers about the falsification of camphor, "the Banians of Cambay confirm this; for they say in secret that when the camphor of Borneo falls short, they mix a little of it with a quantity from China, and call it all falsely camphor of Borneo", show his ease with merchants and traders.[40]

The descriptions of the peculiar plants sent by Franciscan Friars, "they have a strange property, showing that they do not like to be touched", demonstrate his close collaboration with clerics in exploring wonders.[41]

His judgment about East and West medical practices reveals a remarkable open-mindedness. By stating "when we find that our patients do not appreciate our gentle medicines, we deliver them over to Malabars", Orta proved a rather unusual ability to recognise the limits of his knowledge while revealing a remarkable capacity for dialogue with local physicians.[42]

Finally, the new Asian fruits and herbs he described illustrate the thirst for knowledge of the simple people who worked in his house. Slaves, servants, boys, gardeners and his cook were invited to participate in the discourse bringing their knowledge into the *Colloquies*. When

[36] Orta, *Colloquies on the Simples*, p.365.

[37] Orta, *Colloquies on the Simples*, p.217.

[38] Orta, *Colloquies on the Simples*, pp.380–381.

[39] Orta, *Colloquies on the Simples*, pp.109.

[40] Orta, *Colloquies on the Simples*, pp.92–93.

[41] Orta, *Colloquies on the Simples*, p.234.

[42] Orta, *Colloquies on the Simples*, pp.231–232.

he questions his maidservant about the 'negundo', "which is the tree you have been praising so much?" Orta allows for local traditions to enter his treatise.[43]

Garcia de Orta did not identify many of his sources of information, but it seems clear today that among them were the authors of the testimonies gathered in the *Elvas Codex*. Indeed, the coincidence between the reports of those officials and the information described in the *Colloquies on the Simple* leads us to assume that Orta knew the collection. Therefore, it may not be too risky to assume that some of this information had circulated in the East, albeit in a somewhat restricted way, among representatives of the local elites.[44]

We have selected two illustrative examples. When in this collection of data we pick information about the 'lacre of Pegu' provided by Alvaro de Sousa, we realise that Orta used his text.[45] He wrote: [46]

"I was deceived for a long time. [...] Afterwards I conversed with a respectable man with an enquiring mind, who told me that it was a large tree with leaves like those of a plum tree, and that the large ants deposit the lacre on the small branches. [...] They deposit the gum on the tree, as a material thing, washing the branch as the bee makes honey; and that is the truth."

Also when referring to pepper, Orta reported a discussion he had with an apothecary he does not identify. The disagreement between the physician and the anonymous pharmacist resulted from the fact that the latter, wintering in Mozambique, challenged tradition when he realised that white pepper and black pepper came from the same plant, varying only in the degree of maturation. Orta, oddly enough, rejected the true evidence, by introducing some ambiguity in his text. He wrote: "I will tell you a story about what happened to a druggist in the time of a Governor who was very curious about medicines, to whom I spoke of the three kinds of pepper [black, white and long pepper]." On this he related to the Governor that "when he

[43] Orta, *Colloquies on the Simples*, p.323.

[44] Rui Manuel Loureiro, *Fidalgos, missionários e mandarins - Portugal e a China no século XVI*, Lisboa, Fundação Oriente, 2000, pp.396–419; Teresa Nobre de Carvalho, *O mundo natural da Ásia aos olhos do Ocidente*, Ph.D. Thesis, pp.303–313.

[45] As Schurhammer wrote: "Alvaro de Sousa arrived to India in 1538. He sailed in 1545 from Goa to Pegu, where, at the request of the king there, he accompanied him on his campaign against Arakan. He was, however, driven west by a storm so that he returned to India by sailing around Ceylon. In 1546 he was again in Pegu as a *capitão de carreira* with his own newly built ship. […] It seems that he sailed back to Portugal in the beginning of 1548, where he married Francisca de Távora […] and left behind numerous progeny." Georg Schurhammer S.J. *Francis Xavier – His life, his times*, vol. II: India (1541–1545), p.551.

[46] Orta, *Colloquies on the Simples*, p.241. Alvaro de Sousa's report reads: "Em hũu certo tempo do ano vem hũuas formyguas voamdo […] comer as folhas da hũuas arvores do tamanho de nogueyras, e a folha à maneyra de era, as quoaes arvores, se lhe dão hũu golpe, deytão aguoa como samgue e em saymdo coalha-se loguo…" ["At a certain time of the year, ants flying [...] eat the leaves of trees the size of walnut trees, and those leaves as they are cut leak blood-like water that as it comes out immediately curdles."] "Emformação d'Allvaro Souza de como se faz o lacre em Pegu" in Adelino Almeida Calado, *Livro que trata das cousas da India e do Japão*, p.73.

[the apothecary] was wintering in Mozambique [...] he examined the pepper and found amongst it some white from having cast off the outer rind".[47]

Therefore, apparently the information collected by these men trusted by the Portuguese elite living in Goa was passed on to Orta so he could test it. In the *Colloquies on the Simples*, the physician refuted or validated the set of knowledge locally collected and tested by seconded royal officials. This multiple authorship was characteristic of the networks for collection and dissemination of information required to make novelties move from the region where they were collected to the central point where they were treated, validated and later disseminated.[48]

In addition to this informative role, the *Colloquies* were also important in standardising sanitary practices. The "hybrid" nature of overseas medicine and pharmacopeia, of which Garcia de Orta was a pioneer, resulted from an appropriate dialogue between knowledge acquired in European universities and the medical traditions of hakims and local physicians. This ability to criticise his own tradition, while demonstrating a remarkable open-mindedness, revealed one of the most innovative aspects of Orta's work, which, although studied by many, still awaits a more in-depth and detailed analysis.[49]

Final remarks

The reconfiguration of knowledge on botanical–medical matters as proposed by Garcia de Orta was far more complex than it might at first seem. Although observation and experience were crucial allies of textual commentary, they were not sufficient for establishing a novelty.

[47] Orta, *Colloquies on the Simples*, pp.373–374. In the *Elvas Codex*, the apothecary Simao Alvares reported in detail the moment when he observed this new evidence and informed his superiors: "eu, por mynha própria mão, me pus a escolher grão e grão e tirey obra de dous outros arrates de pimemta branqua muyto grossa e muyto alva e pomderosa, […] e depois a trouxe a esta cydade e a mostrey aos botycayros e fisyquos que emtão residiam nela, e, comsulltando todos jumtos, asentamos em huu mesmo parecer com os escrivães malavares del Rey de Cochym, a saber, que a pimemta branqua era a mesma que a preta e da mesma arvore." ["I, with my own hand, started separating the grains one by one and did so with two pounds of very coarse and very heavy white pepper [...] Then I brought it to this city and showed it to druggists and physicists who lived here, and consulting together, we all came to the same conclusion as the Malabar scriveners of the King of Cochin that white pepper is the same as black pepper and comes from the same tree."]

[48] Identical mechanisms for gathering and processing information have been described for the New World. See Antonio Barrera-Osorio, *Experiencing Nature*, pp.128–134.

[49] For more information on the innovative nature of the medical practices described by Garcia de Orta, see among others: Charles R. Boxer, *Two pioneers of tropical medicine: Garcia d'Orta and Nicolas Monardes*, London, The Hispanic and Luso-Brasilian Councils, 1963; P. D. Gaitonde, *Portuguese pioneers in India - Spotlight on medicine*, Bombay, Popular Prakasham, 1983; Richard Grove, "The transfer of botanical knowledge between Asia and Europe 1489-1800," Journal of the Japan-Netherlands Institute, vol. 3, 1991, pp.160-176; Michael Pearson, "Hindu medical practices in Sixteenth-Century Western India: Evidence from Portuguese sources," *Portuguese Studies*, vol. 17, 2001, pp.100-113, Kapil Raj, *Relocating Modern Science - Circulation and the construction of knowledge in South Asia and Europe*, 1650-1900. New York, Palgrave, 2007 or Teresa Nobre de Carvalho, *O mundo natural da Ásia aos olhos do Ocidente*, Ph.D. Thesis, pp.257–270.

It seems clear that it was not enough to be a keen, well-meaning observer for instantly becoming a reliable disseminator of novelties. Apparently, only someone aware of the subtle tactics of the Portuguese presence in the East would be able to propose a reconfiguration of knowledge on Asia's natural resources and elucidate readers on new truths. The absence in India, during the first decades of the century, of such a versatile and qualified person who could fulfil this daunting task seems to have justified the prudent silence of the Portuguese about the natural world they were exploiting. Garcia de Orta ultimately filled this gap, which in Europe troubled scholars and in the Portuguese kingdom worried sovereigns.[50]

Recognition of the value of his work was, as we know, immediate. The rapid appropriation of the book by Carolus Clusius,[51] Juan Fragoso[52] and Cristovao da Costa[53] disseminated throughout Europe and the Iberian empires not only the novelty of its contents but also a new method of collection, validation, transmission and dissemination of knowledge about the natural world.[54]

[50] We refer to the words that Pier Andrea Mathioli, in his comment to Dioscorides, addressed to Portuguese physicians: "Et vous Messieurs les Medecins du Portugal, si la Medecine vous est en recomendation, si voulez enrichir notre profession, exalter & faire grand votre nom, si charité a lieu en votre endroit, si vous avez ce naturel instinct & desir d'aider le genre humain, prennez cette charge: car si le Prince est par vous averti que ce luy sera un grand moyen d'immortalizer son nom, & qu'il sera cause d'un grandissime bien à tout le monde, luy estant, comme l'enten, Prince debonnaire & magnanime, je ne doute point qu'il n'employe tout soin & pouvoir, à remettre en lumiere non seulement le cinamome, mais aussi plusieurs autres drogues, par lesquelles les anciens Médecins ont rendu leurs Antidotes tant exquis & estimez". P. A. Mathioli, *Commentaires à Dioscoride*, Lyon, G. Rouille, 1572, pp.39-40 [1544].

[51] Clusius, *Aromatum et Simplicium aliquot medicamentorum apud Indus nascentium historia*, Antwerp, C. Plantin, 1567.

[52] Fragoso, *Discurso de las Cosas Aromaticas*, *arboles y frutales*, *y muchas otras medicinas simples que se traen de la India Oriental…*, Madrid, Francisco Sanchez, 1572.

[53] Costa, *Tractado de las Drogas y medicinas de las Indias Orientales*, Burgos, Martin de Victoria, 1578.

[54] There is now an extensive bibliography on the dissemination of the new knowledge contained in the *Colloquies on the Simple*. As an example, we mention the recent work of Francine Nave and D. Imhof (eds.), *Botany in the Low Countries (end of 15th–ca 1650)*, Plantin-Moretus Museum Exibition, Gent, Snoeck-Ducaju & Zoon, 1993; Florike Egmond, Paul Hoftijzer and Robert Visser, *Carolus Clusius: Towards a cultural history of a Renaissance naturalist*, Amsterdam, Edita-KNAW, 2007; Florike Egmond, *The World of Carolus Clusius: Natural history in the making: 1550-1610*, London, Pickering & Chatto, 2010; Teresa Nobre de Carvalho, "A apropriação de Colóquios dos Simples por dois médicos ibéricos de Quinhentos" in Palmira Fontes da Costa and Adelino Cardoso (org.) *Percursos na História do Livro Médico (1450-1800)*, Lisbon, Colibri, 2011, pp. 59-72.

Enter the Milanese lapidary: Precious stones in Garcia de Orta's *Coloquios dos simples, e drogas he cousas mediçinais da India* (Goa, 1563)

Rui Manuel Loureiro[*]

Abstract

Somewhere in the city of Goa, on the west coast of India, on an unspecified day in the middle of the sixteenth century, two Europeans are involved in a learned conversation about elephants and ivory. One of them is Garcia de Orta, a renowned Portuguese physician trained at Alcala de Henares and Salamanca, and a longtime resident of the capital city of the Portuguese *Estado da Índia*, where he has been practicing medicine for many years; the other is Ruano, also a graduate from the same Spanish universities, and recently arrived in India on board of the Portuguese annual fleet from Lisbon for purposes of trade. The lively discussion is taking place at Orta's residence, just before the evening meal, when both physicians are interrupted by a woman servant, who enters to announce the arrival of a visitor well-known to the master of the house: "Andrea from Milan, the lapidary, has just arrived", and wishes to speak to Orta, concerning the sale of some precious stones. Apparently, the Portuguese physician is in the possession of two emeralds, a large one and a smaller but clearer one, and the Italian gem-trader has found a possible buyer for both gems. Garcia de Orta salutes the visitor and declares he is willing to sell both emeralds. This curious episode, one of the many that can be found in the pages of the *Colóquios dos simples e drogas medicinais da Índia*, published in Goa in 1563, raises several interesting questions, namely: the large network of informers that Orta brings into play throughout his learned colloquies; the methodology he uses to build a veritable encyclopedia of Asian natural history; the discreet but persistent involvement of the Portuguese naturalist in matters of merchandise; and also his attitude towards precious stones and the so-called lapidary medicine.

Keywords: Garcia de Orta, Precious Stones, Lapidary Medicine, Asia, Sixteenth Century

Somewhere in the city of Goa, on the west coast of India, on an unspecified day in the middle of the sixteenth century, two Europeans are involved in a learned conversation about elephants and ivory. One of them is Garcia de Orta, renowned Portuguese physician trained at Alcala de Henares and Salamanca, and a longtime resident of the capital city of the Portuguese *Estado da Índia*, where he has been practicing medicine for many years; the other is Ruano, also a graduate from the same Spanish universities, and recently arrived in India on board the Portuguese annual fleet from Lisbon for purposes of trade. The lively discussion is taking place at Orta's residence, just before the evening meal, when both physicians are interrupted by a woman servant, who enters to announce the arrival of a visitor well-known to the master of the house: "Está ahi miçer André milanês, o lapidairo", that is, "Andrea from Milan, the lapidary, has just arrived", and wishes to speak to Orta, concerning the sale of some precious stones. Apparently, the Portuguese physician is in the possession of two emeralds, a large one and a smaller but clearer one, and the Italian gem-trader has found a possible buyer for both gems. Garcia de Orta salutes the visitor, declares he is willing to sell both emeralds—"Tudo venderei, e volas darei ambas"—and immediately takes advantage of Andrea's presence to steer the conversation again to elephants, because he knows the Milanese lapidary has relevant information on this topic, since he has been to Pegu – in modern-day Burma –, where he apparently witnessed the hunt for and domestication of elephants.[1]

Although probably based on actual events, the whole scene is entirely fictitious, being described in chapter 21 or colloquy of the celebrated treatise *Coloquios dos simples, e drogas he cousas mediçinais da India*, written by Garcia de Orta and first published in Goa in 1563 by the printer identified in the frontispiece as "Ioannes de endem", which probably is Johannes von Emden.[2] The book is justly famous as the first printed European modern compendium on Oriental natural history and *materia medica*. After nearly three decades of life and experience in India, the Portuguese author had decided to write and publish a work about, in the words of its title, the "simples, drugs, and medical matters of India, as well as some fruits that grow there, and other things concerning the practice of medicine, and other appropriate things worthy of

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[1] Garcia de Orta, *Colóquios dos simples e drogas da Índia*, ed. Count of Ficalho, 2 vols. (Lisbon: Imprensa Nacional – Casa da Moeda, 1987), vol. 1, p. 311: NB. all translations are mine. Concerning the topic of Asian elephants, there is a wealth of studies; see Donald F. Lach, *Asia in the Making of Europe – Volume II: A Century of Wonder*, 3 books (Chicago: The University of Chicago Press, 1970-1977), bk. 1, pp. 124-158, and Gérard Busquet & Jean-Marie Javron, *Tombeau de l'éléphant d'Asie* (Paris: Chandeigne, 2002).

[2] Nothing much is known about the printer of the *Colóquios*, who was active in Goa between 1561 and 1573, and who probably originated from Emden. About this German town, famous for its printing presses and for being a Protestant haven, see Andrew Pettegree, *Emden and the Dutch Revolt: Exile and the Development of Reformed Protestantism* (Oxford: Oxford University Press, 1992).

knowing". Mostly for pedagogical reasons, Orta chose a dialogue framework for his treatise, dividing his work in successive colloquies between two main characters, ORTA and RUANO, two colleagues in the medical profession who had studied together in Spain but had not seen each other for many years: Orta assumes the role of the veteran expatriate, possessor of a large practical experience of Asia, complemented with a thorough theoretical knowledge of his fields of expertise, natural history and medicine; Ruano, on the other hand, is the learned academic, holder of a solid European university education, extremely well read in terms of Western scholarship, but totally inexperienced in Oriental matters. Perhaps Ruano can be seen as a sort of heteronym of Garcia de Orta, created to express some of the author's views and perplexities in a younger phase of his life, when he first arrived in India in the 1530s. Alongside these two protagonists, a large group of secondary characters—the visible part of the author's social world—takes part in the dialogues.[3] But the *Colóquios dos simples*, in reality, as is well known, are much more than what the title proclaims, since besides dealing with plants, drugs and medical practices, many other topics pertaining to daily life in the Indies are extensively treated, such as merchants' practices and trade routes, social customs and religious beliefs, political and diplomatic events, and so on.[4]

The episode involving the Milanese lapidary, the first—but certainly not the last—in the *Colóquios dos simples* where precious stones are mentioned, immediately raises several relevant questions.[5] First of all, it is a paradigmatic example of the methodology used by Garcia de Orta in his literary/scientific endeavors, for he made use of a large network of extremely competent informers, whenever the subject being discussed overreached his actual experiences or knowledge.[6] Andrea was just one informer, among many others, who was knowledgeable about some Oriental region, some natural product, some rare or valuable commodity, or some exotic custom; in this instance, the Italian lapidary was valuable to Orta's purposes for his familiarity with Pegu, where, apparently, he had been on one or more business ventures, to purchase

[3] On the dialogue as an early modern literary device, see Consolación Baranda Leturio, "Formas del discurso científico en el Renacimiento: tratados y diálogos", *Sudia Aurea*, n. 5 (2001), pp. 1-21.

[4] For recent and stimulating studies on Orta and his work, see Teresa Nobre de Carvalho, "*Colóquios dos Simples* de Garcia de Orta: Conversas no interior da Índia", in Gabriela Fragoso & Anabela Mendes (eds.), *Garcia de Orta e Alexander von Humboldt: Errâncias, Investigações e Diálogo entre Culturas* (Lisbon: Universidade Católica Editora, 2008), pp. 165-174; Palmira Fontes da Costa, "Geographical expansion and the reconfiguration of medical authority: Garcia de Orta's *Colloquies on the Simples and Drugs of India* (1563)", *Studies in History and Philosophy of Science*, n. 43 (2012), pp. 74-81; and Palmira Fontes da Costa & Teresa Nobre de Carvalho, "Between East and West: Garcia de Orta's *Colloquies* and the Circulation of Medical Knowledge in the Sixteenth Century", *Asclepio – Revista de Historia de Medicina y de la Ciencia*, vol. 65, n. 1 (2013), pp. 1-13.

[5] For a brief reference to precious stones in Orta's work, see Carlos Fernando Torre de Assunção, "A Mineralogia nos *Colóquios*", *Garcia de Orta*, vol. 11, n. 4 (1963), pp. 715-721.

[6] On Orta's network of informers, see Rui Manuel Loureiro, "Garcia de Orta e os *Colóquios dos simples*: Observações de um viajante sedentário", in Gabriela Fragoso & Anabela Mendes (eds.), *Garcia de Orta e Alexander von Humboldt*, *cit.*, pp. 135-145.

valuable gems. The kingdom of Pegu was famous for its rubies, which are already mentioned in early sixteenth century Portuguese reports, such as those of Tomé Pires and Duarte Barbosa. The former wrote in his 1516 letter to King Manuel I of Portugal that the most prized rubies came from a mine in "Capelãguã", located somewhere beyond the kingdoms of Arakan and Pegu,[7] whereas the latter, writing a report on precious stones around 1516, confirmed that the best and most valued "robis" came from a kingdom called Pegu.[8] And many Portuguese, and other Europeans associated with them, namely Italians, regularly went to the Peguan port-cities of Bassein, Dagon and Martaban in search of these luxury goods, which found ready markets in India and also in Europe.[9]

Secondly, the reference to the lapidary Andrea is significant because suddenly the reader of the *Colóquios dos simples* becomes aware that Garcia de Orta, besides being a distinguished physician and an eminent botanist, was also a merchant, since he traded in precious stones. Previous sections of his treatise had concealed this fact, with the Portuguese physician claiming to be a only a "philosopher", interested mainly in "serious matters", and not a merchant, worried with trade and commodities. In fact, in the colloquy on indigo, Orta specifically claimed that "Anil nam he simple medicinal, senam mercadoria, e per isso nam ha que fallar nella", that is, "since indigo is not a medical drug, but a commodity, there is no need to discuss it" within the framework of his learned conversations with Ruano.[10] However, passages included in several subsequent colloquies clearly show Orta's many connections with the trading world of Asia. In the discussion about cardamom, for instance, the Portuguese physician mentioned "hum meu navio", which he had sent to Ceylon, certainly on a business venture, which means that he owned at least one merchant ship that regularly sailed the Asian seas.[11] On another occasion, Orta alluded to one of his ships, "hum navio meu" that had sailed to Bengal on a trading journey.[12] His business interests were certainly much wider, in terms of products, geographical areas and trading routes and it is evident that Garcia de Orta made use of such commercial expeditions to acquire supplies of the medical products that he regularly used in his daily practice, and also samples of rare or unusual natural products, which he had heard of or was

[7] Armando Cortesão, *A Suma Oriental de Tomé Pires e o Livro de Francisco Rodrigues* (Coimbra: Acta Universitatis Conimbrigensis, 1978), p. 456.

[8] Duarte Barbosa, *O Livro de Duarte Barbosa*, ed. Maria Augusta da Veiga e Sousa, 2 vols. (Lisboa: Instituto de Investigação Científica Tropical, 1996-2000), vol. 2, p. 476.

[9] See Donald F. Lach, *Asia in the Making of Europe – Volume I: The Century of Discovery*, 2 books (Chicago & London: The University of Chicago Press, 1965), bk. 2, pp. 539-560.

[10] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 1, pp. 86-87.

[11] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 1, p. 181.

[12] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 2, p. 375.

curious about. However, precious stones were certainly one of the trading commodities he was concerned with, notwithstanding his allegation, in another colloquy, that he was not very knowledgeable about their current prices.[13] In the colloquy dedicated to "raiz da China", Orta talked about an episode when one of his patients paid for his medical services with "a ring with a diamond" that he later sold for "50 crusados",[14] another proof that he was a man of many trades.

In the early modern age, precious stones were among the most coveted commodities in intercontinental business deals, since they were extremely valuable and, at the same time, very easy to transport and/or conceal. Gems were the perfect articles for long-distance trading ventures and the Portuguese had been attentive to this highly prized merchandise since their earliest voyages to India. The convict that Vasco da Gama disembarked upon his arrival at the Indian port of Calicut announced that the Portuguese came in search of "Christians and spices",[15] but he might as well have added 'and also precious stones'. In fact, the account of Vasco da Gama's voyage prepared by Álvaro Velho includes an appendix describing "the things that can be found in each kingdom and how much they are worth", where precious stones are mentioned, namely rubies, spinels and sapphires.[16] In the following years, as the Portuguese *Estado da Índia* began to take shape, with the establishment of a wide network of coastal territories protected by fortresses and factories set up in friendly city-ports across maritime Asia, Portuguese observers were extremely attentive to any available commodities that could be moved around for a profit. These included, of course, a broad array of precious stones. Around 1516, Duarte Barbosa, for many years a resident of the Indian coastal town of Cannanore, included in his extensive geographical account of maritime Asia a large appendix dealing solely with precious stones. Barbosa's *Livro das cousas do Oriente* described the most noteworthy aspects of many Asian regions that the Portuguese were contacting for the first time, but gems deserved special treatment, on account of their commercial relevance.[17] Soon, Goa would become one of the world's paramount centres in the commerce for precious stones,[18] and the

[13] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 2, pp. 218-219: "E posto que há outras muytas especias destes rubins, delles vos nam quero falar, nem de seus preços, porque não sei isto muito bem sabido, scilicet, o dos preços".

[14] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 2, pp. 269-270.

[15] José Manuel Garcia (ed.), *Viagens dos Descobrimentos* (Lisbon: Editorial Presença, 1983), p. 183.

[16] José Manuel Garcia (ed.), *Viagens dos Descobrimentos*, *cit*., pp. 217-219.

[17] Duarte Barbosa, *O Livro de Duarte Barbosa*, *cit*., vol. 2, pp. 473-503.

[18] For a general overview, see João Teles e Cunha, "Hunting Riches: Goa's Gem Trade in the Early Modern Age", in Pius Malekandathil & T. Jamal Mohammed (eds.), *The Portuguese, Indian Ocean and European Bridgeheads: Festschrift in Honour of Prof. K.S. Mathew* (Kannur: Institute for Research in Social Sciences and Humanities & Fundação Oriente, 2001), pp. 269-304.

annual fleets of the *carreira da Índia* would transport large quantities of oriental gems to Lisbon, and from there to other European destinations.[19]

Turning back to the passage from the *Coloquios dos simples*, there is a third problem, the one concerning the real nature of the stones mentioned by Garcia de Orta: were they really emeralds, or rather some other type of green gems, such as peridot or sapphire? References to emeralds in the earliest Portuguese reports on Asia do not abound, and are somewhat confusing. Duarte Barbosa states that true emeralds originated from the "terra de Babilonia", without being perfectly clear what he meant by the 'land of Babylon', since this place-name was used by the Portuguese authors in connection with the region of Baghdad, and no other evidence points to the existence of emerald mines in those parts. However, the appendix to the *Livro das cousas do Oriente* explains that these stones were "green and very clear", "very light and soft", leaving a copper-colored streak, and in Calicut they were as expensive to buy as diamonds.[20] Barbosa's description does not fit completely, since emeralds leave "a clear or whitish streak".[21] In fact, emeralds were rather rare in Asia in the sixteenth century, for there were no known mines; occasionally some gems were found in areas of present-day Afghanistan and Pakistan. Garcia de Orta was very clear about this, for he stated in one of his colloquies that "there are very few emeralds, and very expensive, and no one knows the whereabouts of the mines".[22] Ruano answered back, recalling an episode, which, by the way, confirms Orta's involvement in the trade in precious stones, when the Portuguese physician had been challenged to buy "a jewel with many small emeralds", but refused to do so on account that he thought that those stones were fake, made from plain glass.[23]

The majority of true emeralds, in the sixteenth century, originated from Nueva Granada, the name attributed by Spanish conquistadors to present-day Colombia. Spanish explorers did find sundry gems in the early decades of the sixteenth century in the northern parts of South America. However, emerald mines were only identified by European observers in the highlands of eastern Colombia in the late 1530s. Immediately afterwards, significant quantities of first-class emeralds were being exported to Europe, namely to Seville and then

[19] See Donald F. Lach, *Asia in the Making of Europe – Volume II*, *cit.*, bk. 1, pp. 113-122; and Nuno Vassallo e Silva, *Subsídios para o estudo do comércio das pedras preciosas em Lisboa, no século XVI* (Lisbon: Assembleia Distrital de Lisboa, 1989).

[20] Duarte Barbosa, *O Livro de Duarte Barbosa*, *cit*., vol. 2, p. 493.

[21] Kris Lane, *Colour of Paradise: The Emerald in the Age of Gunpowder Empires* (New Haven & London: Yale University Press, 2010), p. 28.

[22] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 2, p. 219.

[23] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 2, p. 220.

Lisbon, and from these Iberian cities to Portuguese overseas establishments in Asia.[24] The chronicler Gonzalo Fernandez de Oviedo was among the first to report on Colombian emeralds, in his *Historia General y Natural de las Indias*, parts of which were first published in Seville in 1535 and then in Salamanca in 1547.[25] While living in Hispaniola, he had come across two Spanish veterans who had been to Nueva Granada, who, besides describing the mines, showed him a handful of emeralds. His comment is illuminating: "hasta nuestro tiempo nunca se supo haberse hallado tales piedras de nascimiento, por cristianos", meaning that he had the notion that Europeans were being introduced to a previously unknown, or scarcely known, precious stone.[26] Thus the paucity of information consigned in the *Colóquios dos simples* about emeralds, but Garcia de Orta, always keen on showing his consummate scholarship, took advantage of the opportunity to demonstrate his wide readings on the subject. This, of course, was another relevant aspect of his working method, the permanent dialogue he maintained with the specialized bibliography concerning the subjects or themes that were being dealt with in the different colloquies. Throughout the *Colóquios dos simples*, a rich inter-textual network was created, including dozens and dozens of printed works, mostly pertaining to the field of natural history, but also including other disciplinary areas.[27]

The names by which emeralds were known were the excuse to quote no less than four authors: "Mesue" and his commentator "Cristoforo de Honestis", "Serapio", and "Matheus Silvaticus".[28] In this instance, Garcia de Orta was referring to well-known medical authorities. Cristoforo degli Onesti was a fourteenth-century Italian physician, author of a widely circulated treatise on poisons,[29] which perhaps Orta knew, but the Portuguese naturalist alludes here to the *Expositio super Antidotario Mesue*, first printed in Bologna in 1488, with many subsequent re-impressions, and namely in editions of the works of Mesue Junior, such as *Mesue cum expositione Mondini super canones universales ac etiam cum expositione Christophori de Honestis in antidotarium eiusdem* (Venice, 1502). The Pseudo-Mesue, as he was also known, was a mysterious author

[24] Kris Lane, *Colour of Paradise*, *cit*., pp. 44-56.

[25] Fernández de Oviedo's complete *Historia* was only published in the nineteenth century. See Francisco Esteve Barba, *Historiografia Indiana* (Madrid: Gredos, 1992), pp. 72-81.

[26] Gonzalo Fernández de Oviedo, *Historia General y Natural de las Indias*, ed. Juan Perez de Tudela Bueso, 5 vols. (Madrid: Biblioteca de Autores Españoles, 1992), vol. 3, p. 94. See the translation of this passage in Kris Lane, *Colour of Paradise*, *cit*., p. 43: "until our time no one has ever heard of a discovery, by Christians, of such naturally occurring stones".

[27] On Orta's library, see Count of Ficalho, *Garcia de Orta e o seu tempo*, ed. Nuno de Sampayo (Lisbon: Imprensa Nacional – Casa da Moeda, 1983), pp. 281-305; and also Rui Manuel Loureiro, "European books and libraries in sixteenth century Portuguese India", *RC – Review of Culture*, 31 (1997), pp. 17-30.

[28] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 2, p. 220.

[29] On this curious book, *De venenis*, see Joël Chandelier, "Théorie et définition des poisons à la fin du Moyen Âge", *Cahiers de recherches médiévales*, 17 (2009), pp. 23-38.

from the eighth/ninth century, whose real name, according to the celebrated Leo Africanus, was Yuhanna ibn Masawayh.[30] Although his works were widely read in the sixteenth century, not much is known about him. "Serapio", in the present junction, seems to refer to the Pseudo-Serapion, a thirteenth-century anonymous Arab author, about whom also not much is known, and who wrote *De simplicibus medicinalis opus*, which was frequently published in the sixteenth century.[31] As for Matteo Silvatico, he was a medieval physician and botanist, practicing in Salerno, author of a renowned encyclopedic pharmacopeia, the *Liber pandectarum medicinae*, also repeatedly published in the sixteenth century, which Orta quotes again and again in the *Colóquios dos simples*. Curiously enough, Silvatico abundantly referred to the Pseudo-Serapion, but it is highly probable that the Portuguese naturalist knew both authors and their works.[32] All four authors included information in their writings about the curative properties of precious stones, emeralds included.

This fact then introduces the final question suggested by the above-quoted passage of the *Colóquios dos simples*, the one concerning the presence of precious stones in a book on *materia medica*; but perhaps this is just an issue of historical perspective. Gems, of course, are a product of nature and their study pertained to natural history. Furthermore, from an early-modern point of view, many precious stones were invested with a variety of medicinal properties, curative, protective or prophylactic, thus being the subject of concerned interest on the part of any serious practicing physician.[33] Sixteenth-century European scholars were certainly attentive to the long tradition of mineralogical studies that went back to the Greek author Theophrastus, allegedly the first Westerner to try and gather and organize information about the properties of precious stones between the fourth and third centuries BCE.[34] Emeralds, for instance, were invested by

[30] On Leo Africanus' references to Mesue Junior, see Cyril Elgood, *A Medical History of Persia and the Eastern Caliphate* (Cambridge: Cambridge University Press, 2010), pp. 93-95; and Natalie Zemon Davis, *Trickster Travels: A Sixteenth Century Muslim Between Worlds* (New York: Hill and Wang, 2006), pp. 183-184. For a recent edition of Leo's African geography, see Giovanni Battista Ramusio, *Navigazioni e Viaggi*, ed. Marica Milanesi, 6 vols. (Turin: Einaudi, 1978-1988), vol. 1, pp. 9-469.

[31] He is not to be confused with the older Serapion, Yuhanna Ibn Sarabiyun, a near contemporary of Mesue Junior, on whom see P.E. Pormann, "Yuhanna Ibn Sarabiyun: further studies into the transmission of his works", *Arabic Science and Philosophy*, vol. 14, n. 2 (2004), pp. 233-262; on Mesue, see Raymond Le Coz, *Les médecins nestoriens au Moyen Âge: les maîtres des Arabes* (Paris: Éditions L'Harmattan, 2004), pp. 127-147.

[32] See Count of Ficalho, *Garcia de Orta*, *cit*., pp. 289-290.

[33] See Lynn Thorndike, *A History of Magic and Experimental Science*, 8 vols. (New York: Columbia University Press, 1923–1958), vol. 6, pp. 298-324.

[34] For general histories of precious stones and their lore, see the classic works of George F. Kunz, *The Curious Lore of Precious Stones* (New York: Halcyon House, 1938), and Joan Evans, *Magical Jewels of the Middle Ages and the Renaissance, particularly in England* (Oxford: Clarendon Press, 1922). For more recent approaches, see: Nichola E. Harris, *The Idea of Lapidary Medicine: Its Circulation and Practical Applications in Medieval and Early Modern England, 1000-1750*, unpublished doctoral dissertation (New Brunswick, New Jersey: The State University of New Jersey, 2009); and Claude Lecouteux, *Dictionnaire des pierres magiques et médicinales* (Paris: Éditions Imago, 2011).

Theophrastus with the property of improving the eyesight of those who carried them.[35] A Latin translation of his work—*De lapidibus*—was first published in Venice in the last years of the fifteenth century, with subsequent reprints. Although Orta probably knew the Latin translation of Theophrastus' *De historia et causis plantarum*, prepared in the fifteenth century by the Greek scholar Theodore Gaza and first printed in 1476,[36] it is doubtful that he knew the treatise on gems.[37] But much of Theophrastus' data on precious stones was collected together by Pliny the Elder in the first century, in his *Naturalis Historia*, an encyclopedic work that was repeatedly reprinted in Europe in the fifteenth and sixteenth centuries, and was widely read by early-modern naturalists. Garcia de Orta had at least one edition of this work in his private library, which is quoted in almost every other page of the *Colóquios dos simples*, often with a precise reference to book and chapter. The material on precious stones was concentrated in book 37 of Pliny's encyclopedia. Meanwhile, the Portuguese physician, who frequently expressed his disagreement with Pliny's information and/or hypotheses concerning Asian matters, also possessed either the *Castigationes Plinianae* published by Ermolao Barbaro, with no less than five thousand corrections, or an edition of the *Naturalis Historia* annotated by this fifteenth-century Venetian scholar.[38]

In one of the colloquies where Orta and Ruano discuss diamonds ("da pedra diamão"), the latter questioned the Portuguese physician, claiming that this precious stone "is eminent above all the others, followed by pearls, and then emeralds, and next rubies, if one is to believe Pliny".[39] Orta's answer was somewhat puzzling, because he declared that although the mentioned gems were certainly valuable on account of being rare, and much prized as ornaments, from a medical point of view they were useless, as opposed to "the loadstone and the stone that stops bleeding", which both had far more virtues and had been widely experimented

[35] Theophrastus, *On Stones*, ed. Earle R. Caley & John F. C. Richards (Columbus, Ohio: The Ohio State University, 1956), pp. 99-100.

[36] See Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 2, p. 327, where "Teodoro Guaza" is mentioned. For an opposite view, see Count of Ficalho, *Garcia de Orta*, *cit*., p. 285 ("é mesmo duvidoso que o tivesse lido"). On Gaza, see Deno John Geanakoplos, *Constantinople and the West: Essays on the Late Byzantine (Palaeologan) and Italian Renaissances and the Byzantine and Roman Churches* (Madison: The University of Wisconsin Press, 1989), pp. 68-90.

[37] On Theophrastus, see Charles B. Schmitt, "Theophrastus", in Paul O. Kristeller & F. Edward Cranz (eds.), *Catalogus translationum et commentariorum: Mediaeval and Renaissance Latin translations and commentaries – Volume II* (Washington D.C.: The Catholic University of America Press, 1971), pp. 239-322; and also see Annibale Mottana, "Il pensiero di Teofrasto sui metalli secondo i frammenti delle sue opere e le testimonianze greche, latine, siriache ed arabe", *Rendiconti Lincei – Scienze Fisiche e Naturali*, ser. 9, vol. 12 (2001), pp. 133-241.

[38] Garcia de Orta, *Colóquios dos simples*, vol. 2, p. 295: «nas Anotações de Plinio, diz Hermolao Barbaro». On Pliny, see Trevor Murphy, *Pliny the Elder's Natural History: The Empire in the Encyclopedia* (Oxford: Oxford University Press, 2004); and on Ermolao's comments, see Brian W. Ogilvie, *The Science of Describing: Natural History in Renaissance Europe* (Chicago & London: The University of Chicago Press, 2006), pp. 122-126.

[39] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 2, p. 195.

on.[40] This means that he had some reservations concerning the alleged properties of some precious stones: "quanto he á fisica, nam se costuma usar destes diamães", in other words, "diamonds are not usually used in medical matters". Nonetheless, the Portuguese physician was aware that some of his Indian colleagues often made use of injections of ground diamonds to break gallstones.[41] In the colloquy on diamonds, meanwhile, the Portuguese physician once again exhibited his erudition, bringing to the debate several Spanish authorities, concerning the names and the alleged properties of the precious stone. Some of these references deserve special mention.

One such authority was Andrés Laguna, a physician and philologist who prepared an annotated Spanish translation of the ancient Greek treatise on *Materia medica* by Pedanio Dioscorides, which was first published in Antwerp in 1555, with subsequent editions. Orta owned an edition of Laguna's translation, which he mentions repeatedly throughout the *Colóquios dos simples*.[42] But he had a complicated relationship with his Spanish colleague. For once, as Ruano remarks in one of the last colloquies, he calls him consistently "Tordelaguna, chamandose elle Andreas de Laguna". The Portuguese physician's excuse was rather lame, for he alleged that in Alcala de Henares he had met "an apothecary by the name Tordelaguna, who knew some Arabic and was a consummate herbalist", and he had confused him with the Andrés Laguna translator of the *Materia medica*. He added that having in mind the many errors found in Laguna's edition of Dioscorides, he was glad that they were not by the same person, because "Tordelaguna" had been his friend at university.[43] Andrés Laguna was about the same age as Garcia de Orta, and they both studied at Salamanca, probably contemporaneously. However, the Portuguese claims that they never met, in Salamanca or elsewhere. Another of Ruano's references to Laguna, in the colloquy on pepper, brings some light to the matter, for the Spanish translator and commentator of Dioscorides is said to have declared that the Portuguese were not interested in writing about the Indies, but "their only care is to steal and flay the Indians".[44] This seriously critical remark, which in fact is found in the first edition of Laguna's work, where he sharply criticized the Portuguese for their lack of interest in natural history, would be enough

[40] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 2, p. 195.

[41] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 2, p. 196. The procedure does not seem very consistent with traditional Indian medical systems, and namely Ayurveda. See Robert Sigaléa, *La médecine traditionnelle de l'Inde* (Geneva: Olizane, 1995). On Orta's relations with Ayurveda, see Michael N. Pearson, "Portuguese and Indian Medical Systems: Commonality and Superiority in the Early Modern Period", *RC – Revista de Cultura / Review of Culture*, n. 20 (2006), pp. 116-141.

[42] Count of Ficalho, *Garcia da Orta*, *cit*., p. 293. On Laguna, see Miguel Ángel González Manjarrés, *Andrés Laguna y el Humanismo Médico* (Salamanca: Junta de Castilla y León, 2000).

[43] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 2, pp. 378-379.

[44] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 2, p. 248.

to explain Orta's animosity towards him, and even, perhaps, to justify the appearance of the *Colóquios dos simples*.[45] Dioscorides had written about precious stones and its virtues, of course, and Laguna translated his text, adding numerous annotations.[46] But, needless to say, Andrés Laguna's observations about diamonds were entirely dismissed by the Portuguese physician, on the basis of his Indian experience: "those who claim that diamonds are poisonous are wrong and no certified doctor would write such a thing".[47]

Another Spanish author is quoted in the *Colóquios dos simples*, in the discussion about diamonds, when Ruano mentioned a "chronicler, called Francisco de Tamara" who had written that there were diamonds in Peru.[48] In a previous colloquy, this Spanish scholar had already been mentioned, as "Francisquo de Tamara, no livro que fez dos Custumes".[49] In fact, Orta was alluding in both instances to Johann Boemus' *Omnium Gentium Mores, Leges et Ritus*, published in Augsburg in 1520, which was subsequently translated into several European languages.[50] The Portuguese physician knew well the celebrated work, which he had read in the Spanish translation prepared by Francisco de Támara and published in Antwerp in 1556, under the title *El Libro de las Costumbres de todas las Gentes del Mundo*. The Spanish translator had included new materials in his version of Boemus' book, describing "all the Indies newly discovered by people from Spain".[51] Orta was very critical of Tamara's version, and the work is always quoted in the *Colóquios dos simples* in a dissenting tone. In the present case, his answer to Ruano was

[45] Laguna's annotation on the chapter on pepper, directed at the Portuguese returning from India, is indeed very sharp: "como no sean nada curiosos de lo que conuiene al bien publico, ni à la cõmun disciplina, sino solamente de acumular dinero, y dessollar los Indios desuenturados, no se curan mucho de contemplar aquellas diuinas plantas, para darnos acà entera relation dellas" (Andres Laguna [ed.], *Pedacio Dioscorides Anazarbeo, acerca de la matéria medicinal, y de los venenos mortíferos* [Antwerp: Juan Latio, 1555], p. 237).

[46] Andres Laguna (ed.), *Pedacio Dioscorides Anazarbeo*, *cit*., liv. V, *passim*.

[47] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 2, pp. 196-197. But Orta seems to have misread Laguna, because the Spanish translation of Dioscorides claims that diamonds are useful *against* poisons; and the Spanish physician claims to have learned this property from a "Maestre Juan Portugues, medico excellentissimo" who lived in Rome (Andres Laguna [ed.], *Pedacio Dioscorides Anazarbeo*, *cit*., p.577). I have not been able to identify this Portuguese physician.

[48] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 2, p. 201: "que ha diamães no Peru".

[49] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 1, p. 213.

[50] On Boemus, see the classical analysis by Margaret T. Hodgen, *Early Anthropology in the Sixteenth and Seventeenth Centuries* (Philadelphia: University of Pennsylvania Press, 1971), pp. 111-161; and also Klaus A. Vogel, "Cultural Variety in a Renaissance Perspective: Johannes Boemus and 'The Manners, Laws and Customs of all People' (1520)", in Henriette Bugge & Joan Pau Rubiés (ed.), *Shifting Cultures: Interaction and Discourse in the Expansion of Europe* (Münster: LIT Verlag, 1995), pp. 17-34.

[51] Francisco de Támara (ed.), *El Libro de las Costumbres de todas las Gentes del Mundo* (Antwerp: Martin Nucio, 1556), fl. 249. On the Spanish translator, see Victoria Pineda, "El arte de traducir en el Renacimiento (La obra de Francisco de Támara)", *Criticón*, n. 73, 1998, pp. 23-35; and Hélène Rabaey, "Francisco de Támara: algunos aportes biográficos", *Calamus Renascens*, vol. III (2002), pp. 249-254.

straightforward, briefly dismissing the stories about diamond mines that were closely watched by poisonous snakes: "I saw in that author, that you quote, many fables".[52]

A third author mentioned in the discussion about diamonds is "a Dominican friar called Friar Domingos de Baltanas", who had written that there were mines for these precious stones in Spain.[53] Garcia de Orta was alluding to Domingo de Baltanás and to his *Compendio de algunas cosas notables de España*, published in Seville in 1558.[54] He expressed his doubts regarding the Spanish friar's allegations, once again using a regular methodological procedure applied throughout the *Coloquios dos simples*: the opinion or information of a given author was registered, only to be immediately challenged. The reference to Baltanás (or Valtanás, as he is also known) is rather curious, since the Spanish Dominican had recently been arrested by the Inquisition in Seville, and was on trial from 1561 to 1563, under several accusations, and namely improper conduct towards his female congregation. Orta claimed that he had met Domingo de Baltanás in Spain: "I met this friar in Salamanca, as I recall, and I consider him a good ecclesiastic".[55] Was the Portuguese physician unaware of the recent troubles of Baltanás with the Holy Office? Perhaps he was taking a public stand in favor of his old university acquaintance, who, by the way, was well known for his positions in support of Spanish *conversos*. And Orta, it is well known, was himself a member of a *converso* family, since his Jewish ancestors had converted to Christianity.[56]

All things considered, the colloquy on the "pedra diamão", from a strictly informative point of view, is rather innovative, since Garcia de Orta severely criticizes a number of erroneous believes that were current in his day and age, regarding the location of diamond mines, the extraction of these precious stones, and the gem's alleged properties.[57] But in the beginning of this same colloquy Orta had mentioned the virtues of the "pedra de cevar", to which he returns in its final pages. Once again he refutes one of Laguna's allegations, the one

[52] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 2, p. 201: "eu vi nesse autor que alegaes, muitas fabulas". In fact, Támara was not solely responsible for the legend about snakes guarding diamond mines, because the story had been repeated by many ancient and medieval authors. See Berthold Laufer, *The Diamond: A Study in Chinese and Hellenistic Folk-lore* (Chicago: Field Museum of Natural History, 1915).

[53] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 2, p. 201: "escreve hum frade dominico, chamado frei Domingos de Baltanas, que ha roca de diamães em Espanha".

[54] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 2, p. 201. See Domingo de Baltanás, *Compendio de algunas cosas notables de España y de la conquista y toma del reyno de Granada* (Seville: Martín de Montesdoca, 1558), fl. vii. On Baltanás, see Gianclaudio Civale, "Domingo de Baltanás, monje solicitante en la encrucijada religiosa andaluza: Confesión, Inquisición y Compañía de Jesús en la Sevilla del Siglo de Oro", *Hispania Sacra*, vol. LIX, n. 119 (2007), pp. 197-241.

[55] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 2, p. 201: "Eu conheci ese frade em Salamanca, segundo me parece, e tenhoo por bom religioso".

[56] On the Jewish origins of Garcia de Orta, see Augusto da Silva Carvalho, *Garcia d'Orta* (Coimbra: Imprensa da Universidade, 1934); and I.S. Révah, "La Famille de Garcia de Orta", *Revista da Universidade de Coimbra*, vol. 19 (1960), pp. 407-420.

[57] See the Count of Ficalho's note: Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 2, pp. 206-212.

about the poisonous nature of the loadstone. The Portuguese physician explained that, quite contrary to this opinion, Indian physicians claimed that the loadstone "eaten in small quantities, prevents ageing", and he recalled the story of the Singhalese ruler who had his meals cooked in pans made of loadstone. Orta's remark on this alleged virtue of the loadstone was rather off the mark, but he was careful enough, as usual, to quote a local informer, in this case "Isac do Cairo", the well-known Jewish collaborator of the Portuguese royal authorities in India, who had been in charge of providing the said pans, perhaps to king Bhuvaneka Bâhu, who ruled in Kotte from 1521 to 1551.[58] Still in connection with the loadstone, the *Coloquios dos simples* mentioned the writings of a "Parisian philosopher", who is not identified. Perhaps this was a cryptic reference to the French physician Jean de la Ruelle, who is mentioned elsewhere, in the colloquy on "Altiht".[59] Johannes Ruellius, as he was also known, was the author of several reference works in the fields of medicine and natural history, and namely *De medicinali materia*, a Latin translation of Dioscorides published in Paris in 1516, with several successive re-editions. Garcia de Orta owned one of these, as well as a copy of another of Ruellius' treatises, *De natura stirpium libri tres*, published in 1536 also in Paris.[60] In both of these works, however, relevant passages on the loadstone do not completely agree with Orta's reference.[61] So, perhaps he was alluding instead to François de la Rue, also known as Franciscus Rueus, who published the treatise *De gemmis* in Paris in 1547, which included a chapter on the loadstone.[62] The fact that this French author showed considerable interest in astrological matters might help explain why Garcia de Orta would silence his name.

Information concerning precious stones, excluding diamonds, is concentrated in the colloquy on "pedras preciosas".[63] This is where Orta discussed relevant data about valuable gems that classical and medieval scholarship had invested with medical properties, in the words

[58] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 2, p. 204. On this interesting figure, see José Alberto Rodrigues da Silva Tavim, "Os Judeus e a Expansão Portuguesa na Índia no Século XVI. O Exemplo de Isaac do Cairo: Espião, 'Língua' e 'Judeu de Cochim de Cima'", *Arquivos do Centro Cultural Calouste Gulbenkian*, vol. 33 (1994), pp. 137-261.

[59] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 1, p. 85.

[60] On Jean de la Ruelle and his works, see Edward Lee Green, *Landmarks of Botanical History*, ed. Frank N. Egerton (Stanford, California: Stanford University Press, 1983), pp. 598-657.

[61] Having in mind Garcia de Orta's phrasing, "Hum filosofo parisiense diz, que a pedra de cevar move o ferro pera si, mediante a vertude que nelle emprimio, pera que se mova a ella" (*Colóquios dos simples*, *cit*., vol. 2, p. 205), another, but rather farfetched, possibility would have been Paracelsus, the famous German–Swiss physician and alchemist, who visited Portugal in the opening decades of the sixteenth century; however, he does not seem to have been known as the "Parisian philosopher", and it is unlikely that Orta knew any of his works. On Paracelsus, see Walter Pagel, *Paracelsus: An Introduction to Philosophical Medicine in the Era of Renaissance* (Basel: Karger, 1982); and also Donald F. Lach, *Asia in the Making of Europe*, *cit*., vol. 2, bk. 3, pp. 422-425.

[62] On Rueus, see Lynn Thorndike, *A History of Magic and Experimental Science*, *cit*., vol. 6, pp. 303-306.

[63] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 2, pp. 215-222 (with Ficalho's notes, pp. 223-230).

of Ruano, "precious stones that enter into the compositions and cordial lectuaries".[64] In the opening lines of the colloquy, the Portuguese physician established a limit to the subject, claiming that he would only mention "medicinal stones that are found in India", because otherwise it would be a never-ending story.[65] First, he dealt with sapphires, describing the stone and identifying its origins, those from Ceylon and Pegu being deemed the most valuable; sapphires were an excellent commodity to take back to Europe, according to the Portuguese physician, since they usually fetched high prices. Next there were jacinths and garnets, which were abundant in India, especially in Cambay, and not so valuable. Then, Orta mentioned rubies, explaining that there were different varieties, "muitas especias", one of which was the "carbuncle". On Ruano's request, he immediately dismissed the idea that carbuncles were luminous during the night, classifying these stories as "old wives' tales". Rubies, according to the *Coloquios dos simples*, came in many colors and as many varieties, most of them being available at reasonable prices in the Indian ports. So far, then, Orta's comments were those of a gem merchant, rather than those of a physician interested in the healing virtues of precious stones.

Another precious stone present in this same colloquy was the emerald, according to Ruano "the best stone and the most necessary",[66] as noted above, but perhaps it can be added here that Orta's interlocutor claimed that "our emeralds from Peru are said by a modern doctor to be bad for using in medicine".[67] He was alluding, of course, to Andrés Laguna, who made such a comment on emeralds in his annotations about sapphires in the translation of Dioscorides.[68] Orta's attitude towards Laguna was, as usual, dismissive. He informed his Spanish colleague that many such emeralds from Peru came to India, at first being highly valued, but people soon decided they were false, and so they became worthless. Having in mind that New World emeralds were in fact excellent in colour and water, the opinion of Garcia de Orta is rather perplexing. Nonetheless, the same information appears in a manuscript "Memoria das drogas e pedras preciosas" (Memory of drugs and precious stones), dated from

[64] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 2, p. 215: "pedras preciosas que emtram nas composições e letuarios cordiaes".

[65] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 2, p. 215: "pedras medicinaes e das que há na India". For the location of precious stones in India, see Arun Kumar Biswas, "Gem-Minerals in Pre-Modern India", *Indian Journal of History of Science*, vol. 29, n. 3 (1994), pp. 389-420

[66] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 2, p. 219.

[67] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 2, p. 221: "as nossas esmeraldas do Perú, diz hum doutor moderno, que sam muyto más pera o uso da medecina".

[68] Andres Laguna [ed.], *Pedacio Dioscorides Anazarbeo*, *cit*., p. 563. See José Luis Fresquet Febrer, "El uso de produtos del reino mineral en la terapêutica del siglo XVI. El libro de los *Medicamentos simples* de Juan Fragoso (1581) y el *Antidotario* de Juan Calvo (1580)", *Asclepio – Revista de Historia de Medicina y de la Ciencia*, vol. 51, n. 1 (1999), pp. 55-92.

the 1560s and possibly written in Lisbon by a Portuguese lapidary.[69] In fact, the anonymous author claims that many people bought these emeralds that were styled "do peru" and took them to India as a trading commodity, bringing them back again to Portugal under the guise of oriental gems, to try and increase their value, profiting from the widely diffused notion that all precious stones coming from the East Indies were more costly.[70]

The "colloquy on precious stones" moves on to turquoise, Ruano wanting to know if this stone was used in medicine. Concerning lapidary medicine in general, Orta's answer by now had become standard: 'some say yes, some say no'.[71] That is, whenever the conversation turned around precious stones and their alleged virtues in the practice of medicine, the Portuguese physician, as a rule, refused to take a stand, quoting his informers in some instances, in others outright ignoring the issue. The careful reader of the *Colóquios dos simples* would be at a loss when it came to find out its author's position on the real properties of gems. Nothing was said in concrete terms about the medical properties of sapphires, jacinths, garnets, rubies, emeralds or turquoises. And also nothing was mentioned about the virtues of the "crisolita e da amatista, e do birilo […] e da alaqueca, e do jaspe",[72] only some notions about the various stones' origins, sometimes a reference to their designation in different languages. A curious note about jasper is worth mentioning, for Garcia de Orta claimed that the "stone that is in Genoa, which is said to be of emerald, could in fact be made of this stone [jasper]».[73] The Portuguese physician was here referring to the famous *sacro catino*, which was kept at the Cathedral of San Lorenzo in Genoa, and he correctly deduced that it was not made of emerald. It is not easy to find out how he heard about the legendary cup, which some claimed was none other than the Holy Grail,[74] but he may have read about it in some collection of saints' lives, such as the *Flos Sanctorum*, which was translated to Portuguese and printed in Lisbon in 1513.[75] Two exceptions only, concerning the virtues of precious stones, are found in this colloquy. On the one hand, "olhos de gato" or cat's eyes (chrysoberyl), which, according to Orta, the Indians claimed had

[69] The "Memoria" is kept at the Biblioteca Nacional de Portugal; it was published by Nuno Vassallo e Silva, *Subsídios para o estudo do comércio das pedras preciosas*, *cit*., pp. 21-37.

[70] Nuno Vassallo e Silva, *Subsídios para o estudo do comércio das pedras preciosas*, *cit*., p. 32. See Kris Lane, *The Colour of Paradise*, *cit*., pp. 100-102.

[71] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 2, p. 221: "Alguns me dixeram que si, e outros que não".

[72] Garcia de Orta, *Coloquios dos simples*, *cit*., vol. 2, p. 221: "chrysolite, amethyst, beryl […] and carnelian and jasper".

[73] Garcia de Orta, *Coloquios dos simples*, *cit*., vol. 2, p. 221: "pode ser que a pedra que está em Genoa, que dizem ser de esmeralda, seja desta pedra".

[74] On the *sacro catino*, see Richard W. Barber, *The Holy Grail: Imagination and Belief* (London: Penguin, 2004), pp. 168-169.

[75] See Maria Clara de Almeida Lucas (ed.), *Ho Flos Sanctorum en Lingoage: os Santos Extravagantes* (Lisbon: Instituto Nacional de Investigação Científica, 1988).

the "property of keeping a man's wealth in his possession".[76] Once again the Portuguese physician quoted the opinions of third parties, refusing to unveil his own position on the matter. On the other hand, "alaqueca" or carnelian, a "stone that has a more certain virtue than all the others, because it staunches the blood very suddenly", and which had been previously mentioned by Garcia de Orta in the discussion about diamonds.[77] Apparently, this seems to be the only straightforward concession of the author of the *Colóquios dos simples* to lapidary medicine: he believed and he testified on the basis of his own experience that carnelians were efficient against bleeding. All other precious stones, as far as the Portuguese physician was concerned, held no significant medical value.

Garcia de Orta's refusal to openly endorse the attribution of magical – as opposed to experimental – properties to gems could be a well-planned strategy to overpass the watchful eyes of the Portuguese Inquisition, just recently established in Goa. Garcia de Orta had, after all, Jewish roots, which turned him into a suspect under the eyes of the Holy Office. And before publication, the *Colóquios dos simples* had to overcome a series of legal steps, which included obtaining a permit from Aleixo Dias Falcão, "inquisidor nestas partes", or the Inquisitor in Portuguese India, as the frontispiece of the Goan edition testified. A branch of the Portuguese Inquisition, it is also well known, had been set up in Goa in 1560 mainly on account of the large presence of New Christians in the *Estado da Índia*.[78] This, of course, was reason enough for Orta's caution regarding the lore of precious stones and for the *Colóquios dos simples* to steer clear of lapidary medicine. It would also explain the absence of explicit mentions to a certain number of bibliographical references in a work that otherwise took profit of every opportunity to demonstrate a profound knowledge of medical literature. Garcia de Orta, curiously enough, does not quote or mention any of the standard early modern lapidaries, a set of works that collected available knowledge on precious stones, along with detailed advices on how to use them for protective or curative means. These included, among many others: the *Speculum lapidum* by the Italian physician Camillo Lunardi, published in Venice in 1502; the *Libellus de lapidibus preciosis*, written in the eleventh century by Marbode, bishop of Rennes, but first published in Vienna in 1511; the treatise *De natura fossilium* by the sixteenth century German

[76] Garcia de Orta, *Coloquios dos simples*, *cit*., vol. 2, p. 222: "Diz a gente desta terra, que tem a propriedade de conservar ao homem nas riquezas que tem".

[77] Garcia de Orta, *Coloquios dos simples*, *cit*., vol. 2, p. 222: "esta pedra tem a vertude mais crara que todallas outras, porque estanca o sangue mui de supito".

[78] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 1, p. 1. On the Goa Inquisition, see Ana Cannas da Cunha, *A Inquisição no Estado da Índia: Origens (1539-1560)* (Lisbon: Arquivos Nacionais / Torre do Tombo, 1995). Also see Ines G. Županov, "'The Wheel of Torments': mobility and redemption in Portuguese colonial India", in Stephen Greenblatt & others (eds.), *Cultural Mobility: A Manifesto* (Cambridge: Cambridge University Press, 2009), pp. 24-74.

scholar Georg Bauer, also known as Georgius Agricola, published in Basel in 1546; or the already quoted *De gemmis*, by François de la Rue.[79]

The *Coloquios dos simples* include many more references to natural products classified by Garcia de Orta as *stones*, and namely Armenian stones, bezoar stones, coral stones, pearls and porcupine stones.[80] To all of these the Portuguese physician attributes medical virtues, declaring to have used them repeatedly in his daily practice. But this is in sharp contrast to his silence or ambiguousness concerning real gems. It appears that Orta was not the greatest apologist of the use of precious stones in medical cures. Orta's skepticism is interesting enough, and has frequently been characterized as a sign of his scientific 'modernity'.[81] Perhaps here he was following the advice of one of his favorite authors, Antonio Musa Brasavola, who made "serious restrictions upon the powers attributed to gems or their employment in pharmacy".[82] Among other works, the Italian physician published his *Examen omnium simplicium medicamentorum* in Rome in 1536, where he openly criticized ancient and medieval naturalists, claiming that their knowledge of plants and natural substances was extremely limited.[83] Brasavola's treatise was written in a dialogue form, and most certainly served as Garcia de Orta's model for his own *Colóquios dos simples*, where it is repeatedly quoted, the Italian author being referred to as an inquiring and learned man – "Antonio Musa curioso e bem entendido".[84]

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[79] On these lapidaries, see, respectively: Carla De Bellis, "Astri, gemme e arti medico-magiche nello 'Speculum lapidum' di Camillo Leonardi", in G. Formichetti (ed.), *Il mago, il cosmo, il teatro degli astir: Saggi sulla letteratura esoterica del Rinascimento* (Roma: Bulzoni, 1985), pp. 67-114; Marbod of Rennes, *Marbode of Rennes' (1035-1123) De lapidibus*, ed. John M. Riddle & trans. C.W. King (Wiesbaden: Steiner Verlag, 1977); Georgius Agricola, *De natura fossilium (Textbook of Mineralogy)*, eds Mark C. Bandy & Jean A. Bandy (New York: The Geological Society of America, 1955); and Lynn Thorndike, *A History of Magic and Experimental Science*, *cit*., vol. 6, pp. 298-306. Another interesting absence from the *Colóquios dos simples* are the works of António Luís, a physician based in Lisbon, where he published in 1540 *De occultis proprietatibus*, dealing with plants, animals and minerals. On this rather understudied New Christian, who seems to have coincided in Salamanca with Orta, see Lynn Thorndike, *A History of Magic and Experimental Science*, *cit*., vol. 5, pp. 550-552; and also Américo da Costa Ramalho, "António Luís, corrector de Erasmo", *Hvmanitas*, vol. 45 (1993), pp. 243-254.

[80] Orta's use of this type of *stones* certainly deserves further research. Some of these products have already been approached, in an early modern context. See Jorge Manuel dos Santos Alves, "A pedra-bezoar – realidade e mito em torno de um antídoto (séculos XVI e XVII)", in Jorge Manuel dos Santos Alves, Claude Guillot & Roderich Ptak (eds.), *Mirabilia Asiatica: Produtos raros no comércio marítimo / Produits rares dans le commerce maritime / Seltene Waren im Seehandel* (Wiesbaden: Harrassowitz Verlag & Fundação Oriente, 2003), pp. 121-134; Francesca Trivellato, "From Livorno to Goa and Back: Merchant Networks and the Coral-Diamond Trade in the Early-Eighteenth Century", *Portuguese Studies*, vol. 16 (2000), pp. 193-217; R.A Donkin, *Beyond Price – Pearls and Pearl-Fishing: Origins to the Age of Discoveries* (Philadelphia: American Philosophical Society, 1998); Peter Borschberg, "O comércio, uso e falsificação dos bezoares de porco-espinho na Época Moderna (c.1500-1750) / The Trade, Use and Forgery of Porcupine Bezoares in the early Modern Period (c.1500–1750)", *Oriente*, n. 14 (2006), pp. 60-78.

[81] See for instance A.J. Andrade de Gouveia, *Garcia d'Orta e Amato Lusitano na ciência do seu tempo* (Lisbon: Instituto de Cultura e Língua Portuguesa, 1985), pp. 23-54.

[82] Lynn Thorndike, *A History of Magic and Experimental Science*, *cit*., vol. 6, p. 303.

[83] On Antonio Brasavola, see Lynn Thorndike, *A History of Magic and Experimental Science*, *cit*., vol. 5, pp. 445-471; and Edward Lee Green, *Landmarks of Botanical History*, *cit*., pp. 658-701.

[84] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 1, p. 355. See Count of Ficalho, *Garcia da Orta*, *cit*., p. 293: "Entre todos os auctores modernos, Antonio Musa era o seu predilecto". Also see Lynn Thorndike, *A History of Magic and Experimental Science*, *cit*., vol. 5, pp. 467-468.

Orta's position concerning the use of gems in medicine seems to echo that of Brasavola, for while accepting implicitly its inclusion in the practicing physician's pharmacopeia, he completely dismisses any occult properties traditionally ascribed to them.[85] Was this a result of firm conviction, based on years of learning and experience as a physician in Portugal and in India? After all, he famously declared that "se sabe mais em hum dia agora pellos Portuguezes, do que se sabia em 100 annos pellos Romanos", which in his day and age more new information was revealed by the Portuguese in one day than had been disclosed by the Romans in one hundred years.[86] Perhaps Garcia de Orta was just being cautious, in a context where the Portuguese Inquisition and its overseas delegations closely watched New Christians, while at the same time, in the wake of the Counter Reformation, imposed severe limitations on the books people were allowed to possess and/or read.[87] The methodical study of the natural world and the use of the products of nature in the promotion of human wellbeing were very sensitive areas of activity, which could fall under the watchful eye of an institution the main aim of which was to guarantee the safeguard of the Catholic orthodoxy. Be that as it may, it seems perfectly clear that the *Colóquios dos simples* continues to be worthy of further inquiries: the extensive intellectual network that gives shape to Orta's book, formed by an enormous array of writers and their works, still needs additional study; the complex working methods of the Portuguese physician are not yet perfectly clear; and his vision of the natural world and all of its products and beings awaits deeper clarification.[88] The celebrated Garcia de Orta, 450 years after the publication of the *Colóquios dos simples*, has not yet disclosed all of his secrets, and namely the meanders of his 'split identity' as a New Christian,[89] which seems to have been methodologically relevant in the Portuguese physician's process of knowledge production.

[85] Lynn Thorndike, *A History of Magic and Experimental Science*, *cit*., vol. 5, p. 455.

[86] Garcia de Orta, *Colóquios dos simples*, *cit*., vol. 1, p. 210.

[87] On the censorship activities of the Inquisition involving scientific books, see Henrique Leitão (ed.), *O Livro Científico dos Séculos XV e XVI: Ciências Físico-Matemáticas na Biblioteca Nacional* (Lisbon: Biblioteca Nacional, 2004), pp. 45-51.

[88] Some of these issues have been dealt with in the recent and innovative work by Teresa Nobre de Carvalho, *O mundo natural asiático aos olhos do Ocidente. Contribuição dos textos ibéricos quinhentistas para a construção de uma nova consciência europeia sobre a Ásia*, unpublished doctoral dissertation (Lisbon: Universidade de Lisboa, 2013).

[89] For this extremely relevant topic, see Yirmiyahu Yovel, *The Other Within: The Marranos, Split Identity and Emerging Modernity* (Princeton, New Jersey: Princeton University Press, 2009). Also see Walter J. Fischel, "Garcia de Orta – A Militant Marrano in Portuguese India in the 16th Century", in Saul Liberman & others (eds.), *Salo Wittmayer Baron Jubilee Volume on the Occasion of His Eightieth Birthday*, 3 vols. (Jerusalem: American Academy for Jewish Research, 1974), vol. 1, pp. 407-432, which I have not been able to consult.

Acknowledgements

I wish to express my gratitude to Dejanirah Couto and Teresa Nobre de Carvalho for lively discussions about Garcia de Orta, and to Vasco Resende and João Teles e Cunha for bibliographical support.

THE BURDEN OF TRANSLATION: Eugenios Voulgaris and the circulation of knowledge in eighteenth-century Europe

Manolis Patiniotis

> Received approaches to travel literature are more preoccupied with physical mobility, ongoing out and reporting back, while the emphasis here is on the *interaction* between mobile figures — taken in a broad sense to cover cultural, intellectual and disciplinary displacement — and "other" cultures, in order to examine the types of knowledge or inflections in accepted knowledge practices that result from this process. Indeed, the contributions to this book stress the historical contingency and mutation of these practices introduced by movement itself. The go-between in this sense is thus not just a passer-by or a simple agent of cross-cultural diffusion, but someone who articulates relationships between disparate worlds or cultures by being able to translate between them.[1]

ABSTRACT

Eugenios Voulgaris (1716-1806) was one of the most erudite 18th-century Greek-speaking scholar. In Greek historiography he is known as the person who decisively contributed to the revival of Greek philosophy and the director of some of the most in-fluential schools of the time. Deciphering his scientific thought, however, is not a simple task. Along with his works in metaphysics and logic (literature, religious studies and many other topics) he authored a number of scientific treatises where the attainment of the Enlightenment merged with the neo-Aristotelian philosophy that dominated the Greek intellectual life since the early 17th century. The scientific discourse resulting from Voulgaris' synthesis was primarily contemplative rather than empirical and formed one of the many diverging epistemic endeavors, which marked the early life of modern natural philosophy. What assigns this discourse a particular character is that it epitomizes the life and the career expectations of a man who crossed a variety of intellectual environments trying to bridge different philosophical and political visions and not the mission of a narrowly trained and acutely oriented "scientist". From this point of view, the travels of Eugenios Voulgaris may broaden our understanding of how the circulation of people contributed to the production of new knowledge and the institutionalization of modern science.

[1] Simon Schaffer, Lissa Roberts, Kapil Raj, James Delbourgo (eds.), *The Brokered World: Go-Betweens and Global Intelligence, 1770-1820* (Sagamore Beach: Science History Publications, 2009), p. xiv.

This perspective is particularly relevant to the European periphery as it brings forth the importance of the networks built by the actors and shows that, contrary to the received view, locality played an instrumental role in knowledge production not as a static confinement but as a condition of circulation.

Keywords: knowledge circulation, intellectual networks, locality, translation, Eugenios Voulgaris, Greece

Introduction

Recent scholarship in the history of science has placed emphasis on the notion of circulation. True, that the circulation of scientific ideas and practices had always been a favourite topic for historians of science. The "dissemination" of science or the "spread" of scientific ideas, especially from the "centre" to the "periphery", has occupied a prominent position in reception studies since the early 1970s. However, the way circulation was implemented in this context was greatly affected by the positivist perception both of science and of geography. For much of the received historiography of science, scientific ideas, methods and practices represented parts of an ecumenical and indisputable truth and, in this capacity, they were (or, better, they ought to be) transmitted from the place of their original conception to the rest of the world. The crossing of boundaries between different geographical entities activated different responses depending on the local cultural proclivities. The degree of the positive disposition of a local society towards science was a measure of this society's cultural maturity and of its preparedness to partake in modernity.[2]

Overcoming this positivist perception requires, first of all, the critical reassessment of the centre-periphery dichotomy upon which it is based. In the last 15 years a number of publications and conferences have stressed the importance of removing such Manichean distinctions from the toolbox of historians of science.[3] Especially at the intersection of the

[2] Indicatively: Thomas F. Glick (ed.), *The Comparative Reception of Darwinism* (Austin: University of Texas Press, 1974); Paolo Casini, "Les débuts du newtonianisme en Italie, 1700-1740", *Dix-huitième Siècle*, 1978, 10: 85-100; Thomas F. Glick (ed.), *The Comparative Reception of Relativity* (Dordrecht: Reidel [Boston studies in the philosophy of science], 1987); Anthony Pagden, "The reception of the "new philosophy" in 18th-century Spain", *Journal of the Warburg and Courtauld Institutes*, 1988, 51: 126-140; David Wright, "John Fryer and the Shanghai Polytechnic: making space for science in nineteenth-century China", *British Journal for the History of Science*, 1996, 29: 1-16; Celina Ana Lértora Mendoza, Efthymios Nicolaïdis and Jan Vandermissen (eds.), *The Spread of the Scientific Revolution in the European Periphery, Latin America and East Asia: Proceedings of the XXth International Congress of History of Science (Liège, 20-26 July 1997)*, vol. V, (Turnhout: Brepols Publishers, 1999).

[3] The international collaborative group of historians of science, STEP (Science and Technology in the European Periphery) paid special attention to the center-periphery dichotomy. The issue kept recurring, for many years, in every formal or informal meeting of the group and was extensively discussed in most of its publications. For an overview see Kostas Gavroglu, Manolis

history of science in the European periphery with post-colonial studies, the idea of a metropolitan centre from which scientific truths and cultural values emanated in parallel flows gives gradually way to the more elaborate notion of polycentric communication networks with "multiple layers of authority and interaction".[4]

Two other developments also favoured the turning of historians of science towards a different perception of the circulation of scientific ideas and practices. One such development is closely related with the trend that became widely known as social constructivism.[5]

> Moving away from a conception of science as a system of formal propositions or discoveries, these recent studies understand it as the construction, maintenance, extension, and reconfiguration of knowledge, focusing equally on its material, instrumental, corporeal, practical, social, political, and cognitive aspects. Systematically opting for detailed case studies of the processes through which knowledge and associated skills, practices, procedures, methods, and instruments are created in preference to "big picture' accounts, they have investigated the negotiated, contingent, and situated nature of the sciences. This new scholarship has convincingly shown that scientific research is not based on logical step-by-step reasoning but on pragmatic judgment, much like that involved in practical crafts, and is thus historically and geographically situated. In concert with, and indeed in significant measure inspired by, ethnomethodology and microhistorical approaches, on the one hand, and anthropological insights into the ever-local nature of knowledge across cultural divides, on the other, contingencies of place have thus come to acquire key importance in recent sociological and historical studies of science.[6]

The other development is connected with the radical revision of the notion of geographical or cultural "area".

> As scholars concerned with localities, circulation, and comparison, we need to make a decisive shift away from what we may call "trait" geographies to what we could call 'process" geographies. Much traditional thinking about "areas" has been driven by conception of geographical, civilizational, and cultural coherence that rely on some sort of trait list — of values, languages, material practices, ecological adaptations, marriage patterns, and the like. However sophisticated these approaches, they all tend to see

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Patiniotis, Faidra Papanelopoulou, Ana Simões, Ana Carneiro, Maria Paula Diogo, José Ramón Bertomeu Sánchez, Antonio García Belmar, Agustí Nieto-Galan, "Science and Technology in the European Periphery: Some historiographical reflections", *History of Science*, 2008, xlvi: 153-175.

[4] Mark Harrison, "Science and the British Empire", *Isis,* 2005, 96: 56–63, p. 63. See also, Lissa Roberts, "Situating Science in Global History: Local Exchanges and Networks of Circulation", *Itinerario,* 2009, xxxiii: 9-30 and Manolis Patiniotis, "Between the local and the global: History of science in the European periphery meets post-colonial studies", *Centaurus*, 2013, doi: 10.1111/1600-0498.12027 (where also further bibliography about the de-centralization of Europe and of Western cultural patterns in the context of post-colonial studies).

[5] For an overview see Jan Golinski, *Making Natural Knowledge: Construction and the History of Science* (Cambridge: Cambridge University Press, 1998) and Mario Biagioli (ed.), *The Science Studies Reader (*New York and London: Routledge, 1999).

[6] Kapil Raj, "Beyond Postcolonialism …and Postpositivism: Circulation and the Global History of Science", *Isis*, 2013, 104: 337-347, p. 341.

> "areas" as relatively immobile aggregates of traits, with more or less durable historical boundaries and with a unity composed of more or less enduring properties. […] In contrast, we need an architecture for area studies that is based on process geographies and sees significant areas of human organization as precipitates of various kinds of action, interaction, and motion. […] Put more simply, the large regions that dominate our current maps for area studies are not permanent geographical facts. They are problematic heuristic devices for the study of global geographic and cultural processes. Regions are best viewed as initial contexts for themes that generate variable geographies, rather than as fixed geographies marked by pregiven themes. [7]

Hence, in the context of issues raised by post-Kuhnian history of science and by recent developments in the broader field of social anthropology the notion of circulation has been radically reconsidered. Circulation is no longer about the mobility of scientific "commodities" from one context to another nor about the cultural adaptation of particular scientific "products" to particular social "needs". As opposed to the notions of dissemination and diffusion of scientific ideas and practices, it implies mutually transformative encounters between different localities. No doubt such encounters involve cultural conflicts and power games but the assumed global validity of science is not capable of settling these matters. Quite the contrary, the universality of science is the outcome of the transformations undergone by both scientific achievements and their respective intellectual apparatuses in order to be able to circulate from one locality to another.[8] A second point concerning the revised notion of circulation is the obvious idea that the kind of motion involved in circulation is repeated and tends to return to a point of origin. As a result, circulation affects in equal degrees all the points of the inscribed trajectory, giving rise to stories of "local production, interpretation, appropriation, and use". In order to link these stories "we need an approach that enables us to think about circulation, not as movement that has a designated centre — that is, a clear and privileged point of origin and return — but as a continuous path whose formative trajectory is constituted out of multiple points of local contact and exchange".[9]

The emphasis placed on circulation as a knowledge-making process brought up a new kind of historical actor. Much of the positivist historiography of science drew on the work of the great thinkers who conceived of or definitely shaped the great scientific discoveries. The turn to circulation as a *site of continuous knowledge production* makes visible the work of those intercultural subjects who move across disciplinary *and* territorial borders "by juggling possibilities and

[7] Arjun Appadurai (ed.), *Globalization* (Durham and London: Duke University Press, 2001), pp. 7-8.

[8] Patiniotis, "Between the local and the global", pp. 18-19.

[9] Roberts, "Situating Science", pp. 17-18.

constraints, construct spaces tailored to their own activity, cultivate solutions of continuity, and function through networks".[10] Apparently, the aim of such a reconfiguration is not to do justice to the unsung heroes of science (although this is the favourite version of many historians of the European and colonial "periphery"). Bringing the intercultural agents to the fore and confirming their role in the production of scientific knowledge primarily allows us to tell more nuanced stories about the complex cultural encounters, social negotiations and material potentialities that participated in its making.

As noted in a recent collection, these figures are usually absent from the official histories of the Enlightenment and when they are not, they are typically treated as intellectually parochial scholars, unable to fully embrace the ideal of modernization through reason and science.[11] In this paper we will be concerned with such a figure, whose contemporaneous fame was counter proportional to later historiographical appraisals of his scientific work. Eugenios Voulgaris (1716–1806) was one of the most erudite eighteenth-century Greek-speaking scholars. According to contemporary evidence, he was the person who decisively contributed to the revival of Greek philosophy and the director of some of the most influential Greek schools of the time. In 1803, three years before Voulgaris' demise, Adamantios Korais (1748–1833), the person who is considered by modern Greek historiography as the major representative of the Enlightenment in the Greek intellectual life of the time, noted:

> This most honourable prelate is today the foremost figure among the learned people of the nation. He is one of the first who actively contributed to the moral transformation, which is still in progress among the Greeks. And I wish to emphasize the debt of the nation to him as eagerly as I wish to eternally remember the excitement caused by the publication of his logic in my soul when I was still young; and it is to this excitement I actually owe the few lights I currently possess.[12]

Voulgaris' fame remained intact for more than a century. Quite plausibly so, since his work brought a new spirit into a wide variety of domains. He authored books on metaphysics and logic, literature and theology, history and politics, and, above all, he wrote some of the most

[10] Raj, "Beyond Postcolonialism", p. 347.

[11] Schaffer et al., *The Brokered World*, p. xxx.

[12] Αδαμάντιος Κοραής, *Υπόμνημα περί της παρούσης καταστάσεως του πολιτισμού εν Ελλάδι, συνταχθέν μεν Γαλλιστί και αναγνωσθέν εις την εταιρίαν των ανθρωποτηρητών (τη 6 Ιανουαρίου 1803), μεταφρασθέν δε υπό Αναστασίου Κωνσταντινίδου* [*Memoire sur l'état actuel de la civilisation dans la Grèce, lu a la Société des Observateurs de l'homme, le 16 Nivose, an XI (6 Janvier 1803)*] (Athens, 1833), pp. 15-18 (quote on p. 18). Another author who testifies to Voulgaris' importance is Constantinos Koumas (1777–1836), also a major representative of the Enlightenment in the Greek intellectual life of the time. See: Κωνσταντίνος Μ. Κούμας, *Ιστορία των Ανθρωπίνων πράξεων* [*History of human affairs*], v. 12 (Vienna, 1832), pp. 559-564.

influential scientific treatises of his time, in which he attempted to merge the attainments of modern European thought with the neo-Aristotelian philosophy, which dominated Greek intellectual life from the early seventeenth century.[13] However, when in the late 1940s historian Constantinos Dimaras (1904–1992) invented the notion of "Neohellenic Enlightenment" as a period that marked the linking of the eigheteenth-century Greek society with the European (particularly French) Enlightenment, the place of Voulgaris on the intellectual map changed drastically. For Dimaras himself, Voulgaris was a progressive scholar who gradually turned conservative as he was becoming older and more established,[14] whereas for other historians he was a transitional figure unable to fully appreciate the scientific progress taking place in Europe due to his unwillingness to take distance from the philosophical and theological commitments of his native cultural context.[15] Voulgaris was the hero of an unfulfilled modernization.

On closer examination, however, Voulgaris turns out to be quite typical of an era characterized by "multiple engagements" and the agency of "polycentric communication networks". His work epitomizes the life and the career expectations of a man who crossed a variety of intellectual environments trying to bridge different philosophical and political visions, rather than the mission of a narrowly trained and acutely oriented "scientist". Voulgaris was a "go-between", like many other scholars of his time. Thus, placing his story in the historiographical context of circulation, we shall try to elucidate some aspects of his intellectual agenda, which usually go unnoticed by contemporary historians. To do so, we need to loosen the tight frame of traditional historiography, particularly in the following three points:

- We must take seriously the fact that until well into the 19th century, the disciplinary divisions we are now familiar with had not yet been established. Philosophy, science, theology, history and literature could be parts of the same knowledge endeavours. As a

[13] Γεώργιος Αινιάν, *Συλλογή ανεκδότων συγγραμμάτων του αοιδήμου Ευγενίου του Βουλγάρεως καί τινων άλλων μετατυπωθέντων* [A collection of unpublished writings of the most unforgettable Eugenios Voulgaris and some more of his writings reprinted], 2 vols., (Athens, 1838); Κωνσταντίνος Ν. Σάθας, *Νεοελληνική Φιλολογία: Βιογραφίαι των εν τοις γράμμασι διαλαμψάντων Ελλήνων (1453–1821)* [*Neo-Hellenic Literature: Biographies of Greeks who shone in letters (1453–1821)*] (Athens, 1868), pp. 566-571.

[14] Κωνσταντίνος Θ. Δημαράς, *Νεοελληνικός Διαφωτισμός* [*Neohellenic Enlightenment*], (6th edition) (Athens: Ερμής, 1993), p. 15.

[15] Παναγιώτης Κονδύλης, *Ο Νεοελληνικός Διαφωτισμός: Οι φιλοσοφικές ιδέες* [*Neohellenic Enlightenment: The philosophical ideas*] (Athens: Θεμέλιο, 1988). See, also, indicatively: Ευάγγελος Π. Παπανούτσος (ed.), *Νεοελληνική Φιλοσοφία* [*Neohellenic Philosophy*], vol. 1, (Athens: Αετός, 1953), p. 28; Νίκος Ψημμένος (ed.), *Η Ελληνική Φιλοσοφία από το 1453 ως το 1821* [*Neohellenic Philosophy from 1453 to 1821*], vol. 2, *Η επικράτηση της νεωτερικής φιλοσοφίας* [*The prevalence of modern philosophy*] (Athens: Γνώση, 1989), p.32.

result we will focus on Voulgaris' *knowledge* quests rather than on a supposedly well-delimited *scientific* enterprise.

- Speaking of circulation in a pre-nationalistic era we must place networks over the geography of fixed borders. Networks are dynamic systems encompassing multiple *asymmetrical* flows, which connect disparate intellectual and political environments. In what follows we shall see how Voulgaris' knowledge quests were motivated and shaped by his movement across networks spanning three different empires and a variety of cultural contexts.
- We shall focus on the notion of locality as opposed to the notion of location. Location indicates a more or less immutable entity on the map. Locality, at least in the sense we will use it in this paper, is a set of locally defined cultural qualities, but essentially disengaged from the institutional and social structures that engendered them. Moreover, locality is the ability of the actors to *perform* distinct cultural identities in the course of their travels, informed by, but not necessarily identical with those assigned by their native environment. In this particular sense, locality is movable and apt to transformation. Voulgaris' crossing of a variety of intellectual and political environments represents such a *moving locality*, which turned out to be a most suitable context for new knowledge production.

The Greek context

The scientific travels of the eighteenth-century Greek-speaking scholars display some particular features when compared to those of other European scholars. The Greek intellectual space did not coincide with a specific geopolitical territory, let alone a national state. Greek education and Christian Orthodox religion unified a wide and heterogeneous range of populations spread in various areas of the Ottoman Empire and of central Europe.[16] It is indeed interesting to notice the absence of nationalistic sentiments in the largest part of such populations. Contrary to the received views of many Greek historians, the collective identity of most Greek-speaking people was a composite consisting of loyalty to the Sultan, a steady commitment to the practice of the Orthodox Church, a deeply rooted aversion for Catholicism and a culturally guided admiration for the achievements of Greek antiquity. Clear nationalistic

[16] Γιώργος Τόλιας, "Η συγκρότηση του ελληνικού χώρου 1770-1821" ["The construction of the Greek national space 1770-1821"] in Βασίλης Παναγιωτόπουλος (ed.), *Ιστορία του Νέου Ελληνισμού, 1770-2000* [*History of New Hellenism, 1770-2000*], vol. 1, (Athens: Ελληνικά Γράμματα, 2003) , pp. 59-74.

sentiments and the first uncertain claims for a political unity that would transcend the nostalgia for the revival of Byzantium did not appear before the late eighteenth century, when Greek-speaking merchants of various central European communities felt compelled to strengthen their ties against the economic competition of other "nations".[17] Thus, a basically religious term "έθνος" (nation), came to signify for them a political and economic association, which gradually appropriated a glorious past (Ancient Greece) and projected itself into the future as part of an alternative arrangement of the Eastern European space. Quite naturally, the course of these developments was not rectilinear, but an investigation of such matters falls outside the scope of this paper. What is important for our study is that Eugenios Voulgaris not only moved across a changing Europe but also experienced the uncertainties of the emerging Greek national identity. This is an essential difference from other travelling scholars, the Spanish *pensionados*[18] and the Portuguese *estrangeirados*[19] for example, who had or envisioned a well-formed state apparatus to place the results of their intellectual undertakings.

Another point that should be stressed has to do with the intellectual context from which Voulgaris emerged. Many historians take it for granted that by the mid-eighteenth century the experimental and mathematical culture of modern science had been adopted by the majority of natural philosophers. However, in many cases this is not true. Until quite late in the eighteenth century there still were extended areas of the European intellectual landscape occupied by the traditional patterns of scholarship oriented towards education and text commentaries.[20] The Greek intellectual life was one of these cases. Although we should not mistake Greek-speaking scholars for mere pedagogues, it is a fact that their cognitive pursuits were almost exclusively placed in the context of the educational structure. And the means for the achievement of their intellectual goals were basically discursive, viz. teaching and writing for teaching purposes. Even pieces of knowledge representing the attainments of modern natural philosophy

[17] Όλγα Κατσιαρδή-Hering, "Η Ελληνική Διασπορά: Το εμπόριο ως γενικευμένη εθνική εξειδίκευση" [Greek diaspora: Commerce as national expertise"] in Παναγιωτόπουλος, *Ιστορία του Νέου Ελληνισμού*, v. 1, 87-112; Όλγα Κατσιαρδή-Hering, "Η Ελληνική Διασπορά: Η γεωγραφία και η τυπολογία της" [Greek diaspora: Its geography and its typology"] in Σπύρος Ι. Ασδραχάς (ed.), *Ελληνική Οικονομική Ιστορία, ΙΕ'-ΙΘ' αιώνας* [*Greek economic history, 15th to 19th centuries*] (Athens: Πολιτιστικό Ίδρυμα Ομίλου Πειραιώς, 2003) v. 1, 237-247.

[18] Antonio García Belmar, José Ramón Bertomeu Sánchez, "Constructing the Centre from the Periphery: Spanish Travellers to France at the Time of the Chemical Revolution" in Ana Simões, Ana Carneiro, Maria Paula Diogo (eds.), *Travels of Learning: A Geography of Science in Europe* (Dordrecht: Kluwer Academic Publishers, 2003), pp. 143–188.

[19] Ana Carneiro, Ana Simões, Maria Paula Diogo, "Enlightenment Science in Portugal: the Estrangeirados and their communication networks", *Social Studies of Science*, 2000, 30: 591-619.

[20] See, for example: Christia Mercer, "The Vitality and Importance of Early Modern Aristotelianism" in Tom Sorell, (ed.), *The Rise of Modern Philosophy: The Tension between the New and Traditional Philosophies from Machiavelli to Leibniz* (Oxford: Clarendon Press, 1993), pp. 33-67; Christoph Lüthy, "What to do with seventeenth-century natural philosophy? A taxonomic problem", *Perspectives on Science*, 2000, 8: 164–195.

entertained a discursive reception by Greek-speaking scholars, not in the sense that they were passively and unalterably repeated by them, but in the sense that they were appropriated in an intellectual structure, which was trained to produce new knowledge about nature by means of contemplation and written commentaries. Here again, from a comparative point of view, we can observe significant differences from other European scholars. Besides the differences in the methods of knowledge production, the confirmation and the practical application of such knowledge seem to be absent in the Greek case. Lacking the economic and institutional background that would profit from the appropriation of particular pieces of scientific and technological knowledge, Greek-speaking scholars got involved with the new natural philosophy with a view to extending the limits of traditional philosophy and upgrading its application in humanistic education.

In what follows, we will accompany Voulgaris on his travels keeping in mind the above clarifications. Like so many other European scholars of his time, as Voulgaris travelled, he brought along a whole set of intellectual pursuits. These pursuits altered through space and time (and, depending on the circumstances, became more or less ambitious), but they were never restricted to a simple search for scientific truth. As a matter of fact, neither the acquisition of scientific knowledge nor its circulation had ever been deliberate purposes of Voulgaris' travels. They both, rather, resulted from his efforts to establish himself in a variety of social, intellectual and political environments throughout a changing Europe.

Westwards

Voulgaris travelled a lot and wrote a lot. Interestingly enough, the first important scientific travel of Voulgaris is a controversial one. According to the sources, Voulgaris spent some time between 1738 and 1742 at the University of Padua where he familiarized himself with modern philosophy. However, since his name does not appear in the university registers, this information remains unconfirmed. At the same time, it is a confirmed fact that upon his return to the Greek-speaking areas of the south-western Balkans, he launched his educational career backed by his reputation as a systematic exponent of modern philosophy.[21] This ambiguity is quite telling not only for Voulgaris himself, but also for the majority of his contemporary scholars: whether Voulgaris studied in Padua or not, that particular university

[21] Κούμας, *Ιστορία των Ανθρωπίνων πράξεων*, pp. 559-561; Αινιάν, *Συλλογή*, pp. ιγ΄-ιδ΄; Σάθας, *Νεοελληνική Φιλολογία*, pp. 567; Κωνσταντίνος Χατζόπουλος, *Ελληνικά σχολεία στην περίοδο της οθωμανικής κυριαρχίας (1453-1821)* [*Greek schools in the period of the Ottoman rule (1453-1821)*] (Θεσσαλονίκη: Βάνιας, 1991), p. 94.

was the main channel through which modern natural philosophy was introduced into the Greek intellectual life.[22] So, quite a few nineteenth-century historians took it for granted, without closely questioning the sources, that Voulgaris' acquaintance with modern philosophy took place in Padua. In a certain sense, by most probably *not having studied* in Padua, Voulgaris became representative of his generation who had mostly studied there.

After travelling to Venice, for studies or otherwise, Voulgaris became a renowned teacher of higher philosophical courses in schools founded and funded by rich merchants in Epirus and western Macedonia. He moved among the largest cities of the area, pursuing better contracts but also pressed by the hostility of the established neo-Aristotelian teachers. In the mid-1750s he gained the consent of the main social powers of the emerging Greek society to establish and direct a higher school at Mount Athos. During the short period of its function, the school became one of the most prominent educational experiments in the Ottoman Balkans gathering a great number of students and providing the most elaborate philosophical and scientific training of the time.[23] After its closure due to disagreements among the involved parts, Voulgaris' ambitions were aimed at the Orthodox Patriarchate itself. He moved to Constantinople and attempted to establish himself as director of the Patriarchal Academy.[24] However, contrary to many of his contemporaries who saw their careers culminating in Constantinople, Voulgaris was unable to settle down for a long time. After intense disagreements with the Patriarchal environment, he departed for Central Europe to initiate a second career.

Voulgaris was a representative figure of a new generation of scholars, who claimed social power on the basis of their intellectual skills. This endeavor required overcoming the limitations of traditional philosophical teachings and compiling a new discourse where the attainments of the new natural philosophy would come to terms with the intellectual requirements of the local philosophical and religious traditions.[25] During the period from 1742 to 1762, when eventually he departed for Leipzig, Voulgaris produced the greatest part of his scientific work. Translation was one of the most important means he employed to shape his

[22] Manolis Patiniotis, "Scientific Travels of the Greek Scholars in the 18th Century" in Ana Simões, Ana Carneiro, Maria Paula Diogo (eds.), *Travels of Learning. A Geography of Science in Europe*, (Dordrecht: Kluwer Academic Publishers, 2003), pp. 49-77, on pp. 58-60.

[23] Άλκης Αγγέλου, *Των Φώτων* [*Of the Lights*] (Athens: Ερμής, 1963), pp. 111-132.

[24] Αινιάν, *Συλλογή*, pp. ια΄-ιζ΄; Τάσος Α. Γριτσόπουλος, *Πατριαρχική Μεγάλη του Γένους Σχολή*, [*Patriarchal Academy*] (Athens: Βιβλιοθήκη της εν Αθήναις Φιλεκπαιδευτικής Εταιρείας, 1966), vol. 1, pp. 388-390.

[25] Patiniotis, "Scientific travels", pp. 68-69; Manolis Patiniotis, "Textbooks at the Crossroads: Scientific and philosophical textbooks in 18th-century Greek education", *Science and Education,* 2006, 15: 801-822.

intellectual agenda. Indeed, in a time when copyright ethics was still extremely loose and professional writing took great advantage of its scholastic past, translation (as a form of "commentary") was inseparable from genuine creation. This also made Voulgaris representative of his age in another manner: According to Anthony Pym, the most important feature of translator's identity is its cross-cultural character. Translators themselves, as well as their patrons and audiences aim at crossing certain kinds of boundaries. It is the translator, however, that is the figure who most typically personifies this aim by standing among cultures as an intermediate individual. In this sense, the study of translators' own practices, career choices and social strategies can provide a broad picture of the cultural exchange of their time — significantly broader than that drawn from the mere textual analysis and the emphasis placed on the "circulation of ideas".[26]

Drawing on his Italian years, Voulgaris carefully chose a number of well-known treatises to work on. Among others, he translated Willem's Gravesande's *Physices elementa mathematica* and *Introductio ad philosophia,* Antonio Genovesi's *Elementa metaphysicae* and André Tacquet's *Elementa geometriae.* He also compiled his own treatises based on the above books as well as on works such as Petrus van Musschenbroek's *Elementa physicae,* Samuel Clarke's annotated translation of Jacques Rohault's *Physique,* Mme du Châtelet's *Institutions Physiques,* John Locke's *Essay* and Voltaire's *Éléments de la philosophie de Neuton [sic].*[27]

Voulgaris' intellectual production primarily aimed at securing him a position at the patronage networks of the emerging Greek society. The commercial social groups of the south-western Balkans, as well as the conservative but Europeanized Phanariots of Constantinople, were willing to sponsor scholars who got involved with modern philosophy and experiment with educational programs transcending the narrow Aristotelian curricula that dominated Greek education by the mid-eighteenth century. However, neither scholars themselves nor their intended patrons had yet reached a consensus about a new intellectual agenda. They rather

[26] Anthony Pym, *Method in Translation History* (Manchester: St. Jerome Publishing, 1998), pp. ix-xi.

[27] Willem Jacob van's Gravesande, *Physices elementa mathematica, experimentis confirmata. Sive introductio ad philosophiam Newtonianam,* 2 vols. (Leyden, 1720-1721); idem, *Introductio ad philosophiam: metaphysicam et logicam continens (*Leyden, 1737); Antonio Genovesi, *Elementa Metaphysicae. In usum privatorum adolescentium Mathematicum in morem adornata (*Naples, 1743); André Tacquet, *Elementa geometriae planae ac solidae, et selecta ex Archimede theoremata. Summa cura emendata… a Guilelmo Whiston (*Antwerpen, 1672)*;* Jacques Rohault, *System of Natural Philosophy illustrated with Dr. Samuel Clarke's Notes, taken mostly out of Sir Isaac Newton's Philosophy,* 2 vols. (London, 1723) (or one of the Latin editions that came out between 1697 and 1713); Petrus van Musschenbroek, *Elementa physicae conscripta in usus academicos* (Leyden, 1734); Gabrielle-Émilie le Tonnelier de Breteuil, Marquise du Châtelet, *Institutions Physiques, adressées à Mr. son Fils* (Amsterdam, 1742); François-Marie Arouet de Voltaire, *Éléments de la philosophie de Newton* (Amsterdam, 1738). For John Locke's influence on the Greek philosophical thought see: Paschalis M. Kitromilides, "John Locke and the Greek Intellectual Tradition: An Episode in Locke's Reception in South-East Europe" in Graham Alan John Rogers (ed.) *Locke's Philosophy: Content and Context* (Oxford: Clarendon Press, 1994), pp. 217-235.

contested over a variety of educational patterns that reflected the different visions they had about the future of the decaying Ottoman Empire. Under such circumstances, the production of a new philosophical discourse involved the sensitive issues of cultural and religious identity, which would mark the course toward a new social arrangement. Within this atmosphere, Voulgaris did not simply translate or compose scientific works. Like many of his contemporaries, he deliberately focused on the production of a new philosophical discourse that would reflect the inquiries of his time. But he did not use the new natural philosophy to overthrow the outmoded Aristotelian tradition, as is generally believed. He rather aimed at enriching the Aristotelian worldview with the new findings and revamping its exegetical power through the methodological attainments of modern empiricism. He seemed to believe that such a reenactment of the Aristotelian philosophy would enable Greek culture to play a unifying role in the highly diversified landscape of the European philosophy.[28]

One of the many examples of this attitude is the way Voulgaris dealt with modern atomism. In his *Philosophers' Favorites* (*Τα αρέσκοντα τοις φιλοσόφοις*, published in 1805 but written much earlier), he clearly endorsed Newton's views on the constitution of matter. Speaking of the "first principles of natural body" he explained that the building blocks of all material bodies were the immutable and indivisible minute particles created by God for this purpose. Reviewing a variety of opposite views, "ancient and modern", he found himself against the objection of the Peripatetics who claimed that the first principles of natural body were *matter* and *form* rather than atoms. Surprising as it may sound, Voulgaris did not seize the opportunity to dispose of the outmoded Aristotelian hylomorphism, but he patiently explained that there were, actually, two kinds of principles, the natural and the metaphysical ones. In this regard, matter and form were indeed the first principles of natural body, but they belonged to the metaphysical genre. Atoms, *which also consisted of matter and form*, were the first *natural* principles of body, but metaphysically speaking they were second order principles. Through this explanation, the Aristotelian hylomorphism retains its exegetical power without contradicting the Newtonian atomism. There is more, though. In his *Elements of Metaphysics* (*Στοιχεία της Μεταφυσικής*, also published in 1805 but written earlier), Voulgaris resumed the discussion and completed the synthesis in a highly elaborate way: in a language, which wavered between the traditional and the modern natural philosophy he explained that the *form* of the atoms was

[28] Manolis Patiniotis, "Eclecticism and Appropriation of the New Scientific Methods by the Greek-speaking Scholars in the Ottoman Empire" in Feza Günergun, Dhruv Raina (eds.), *Science between Europe and Asia: Historical Studies on the Transmission, Adoption and Adaptation of Knowledge* (Dordrecht-Heidelberg-London-New York: Springer, 2011), pp. 193-206.

the set of primary qualities characterizing them and distinguishing them from each other. And the *form* of a natural body was nothing else than the macroscopic combination of these qualities resulting from a certain arrangement of atoms. Thus, Voulgaris bridged the metaphysical Aristotelian hylomorphism with the Newtonian atomism, concluding with the acute remark that even Aristotle himself when he came to physical problems preferred to explain the phenomena through the arrangement of the elementary parts of bodies rather than by employing the metaphysical categories of matter and form.[29]

As will become clearer in what follows, Voulgaris was an intermediate individual in religious terms, as well. Although his Orthodox faith was deep and stable (himself an ordained deacon, from pretty early), his loyalty to the Ecumenical Patriarchate of Constantinople was rather loose. His involvement with modern natural philosophy clearly reflected this ambiguous attitude. As a matter of fact, one reason for his frequent arguments with the patriarchal circles was his effort to displace the Orthodox Church-sanctioned teachings of the early 17th-century neo-Aristotelian philosopher Theophilos Korydaleus (1563/1574–1646). Voulgaris was aware that the adoption of the particular version of Aristotelianism by the Orthodox Church was based on mutual toleration, but it did not reflect a real dogmatic synthesis between natural philosophy and theology.[30] Thus, when he came to translate and compose his naturalistic and mathematical works, he displayed a strong preference towards authors and ideas originating in the tradition of natural theology, hoping that baptizing the traditional natural philosophy in Newtonian waters would restore its lost connection with religion.[31]

In this respect, it is hardly surprising that one of the first books Voulgaris translated and annotated when he launched his journey to central Europe was a book on religious tolerance. True faith was one of Voulgaris' main concerns, so when he translated *Essai historique et critique sur les dissensions des églises de Pologne* (originally published in Basle in 1767) his intention was to subscribe to Voltaire's denunciation of Catholic Church's anti-Orthodox policy. But he apparently took the chance also to initiate an approach to Catherine II, who in 1768, the very

[29] Μανώλης Πατηνιώτης, *Στοιχεία Φυσικής Φιλοσοφίας: Ο ελληνικός επιστημονικός στοχασμός τον 17ο και τον 18ο αιώνα* [*Elements of Natural Philosophy: The Greek scientific thought in the 17th and the 18th centuries*] (Athens: Gutenberg, 2013), pp. 322-333.

[30] Μανώλης Πατηνιώτης, "Οι Pestifarae Questiones του Κυρίλλου Λουκάρεως και η ανάδυση του κορυδαλικού προγράμματος" ["Kyrillos Loukari's *Pestifarae Questiones* and the emergence of Theophilos Korydalea's philosophical program"] in Γιώργος Ν. Βλαχάκης and Θύμιος Νικολαΐδης (eds.), *Proceedings of the conference Βυζάντιο-Βενετία-Νεότερος Ελληνισμός. Μια περιπλάνηση στον Κόσμο της Ελληνικής Επιστημονικής Σκέψης* [*Byzantium-Venice-Modern Hellenism. A wandering in the world of the Greek scientific thought*] (Athens: Εθνικό Ίδρυμα Ερευνών, 2004), pp. 211-244.

[31] Μανώλης Πατηνιώτης, "Ευσεβής επιστήμη: Ο Νεύτωνας στην Ορθόδοξη Ανατολή του 18ου αιώνα" ["Pious Science. Newton in the Orthodox Orient of the 18th century"] in the conference proceedings *Ορθοδοξία, Έθνος και Ιδεολογία* [*Orthodoxy, Nation and Ideology*] (Athens: Σχολή Μωραΐτη, 2007), pp. 63-81.

same year Voulgaris' translation was published in Leipzig, invaded Poland in order to guarantee the safety of the country's Orthodox populations. The Greek translation of the *Essai historique…* is a typical example of Voulgaris' translatological strategy. Like many translations of his time it is not primarily a faithful transfer of a person's ideas from one language to another; it is rather a vehicle elaborately used by Voulgaris to convey his own theological and political agenda. Addressed to Catherine the Great—to whom Voltaire also addressed the original work—Voulgaris complemented the original tract with an equally long text exploring the limits of religious tolerance from the Orthodox point of view. The *Essay on religious tolerance* (*Σχεδίασμα περί της ανεξιθρησκείας*) he appended to Voltaire's text, as well as the many documentary and explanatory notes with which he enriched the translation throughout aimed at outlining a context for the reception of Enlightenment's critique against religion in a time of uncertainty for the Eastern Orthodox world. Contrary to Voltaire, Voulgaris did not perceive religious freedom as a political issue; he rather intended to show that it was an expression of Christian piety and forbearance towards dissenters aiming at protecting Church from their eroding influence. Absolute freedom of thought is acceptable only as far as arts and sciences are concerned, he argued. But concerning matters of faith, the nature of which transcends the capacity of mere logical thinking, it is a foolish thing to practice unlimited tolerance. And it is the task of the wise monarch to safeguard the limits of such spiritual exercises.

It is clear that Voulgaris had already started perceiving Catherine the Great as an alternative center of power in the sensitive balance of the Orthodox world. As already happened in the past, his travels were guided by his search for the proper patronage scheme to set himself at its service. In the course of time it turned out that the Russian court was the most promising such environment. But in order to fully understand Voulgaris' incentives we should keep in mind that this realization was not clear at the beginning of the second phase of his travels. When he left Constantinople, he spent a year in Bucharest, hosted by the Orthodox ruler of Wallachia. Bucharest was the seat of one of the most important Greek higher schools, but it seems that Voulgaris, already laden with his past philosophical disputes, did not gain chances to be a candidate for the directorship of the school. According to some indication, he also visited Jasy, to get in contact with one of his major patrons, who was soon to be appointed ruler of Moldova. Neither this visit, however, had any significant outcome concerning his involvement with the prestigious high school of the city.[32] So in 1764 we find him in Leipzig supervising an

[32] Γριτσόπουλος, *Πατριαρχική Μεγάλη του Γένους Σχολή*, p. 404.

ambitious publishing project. Education was still his focus and the first books he put forward were intended for the use of teachers and students of the Greek higher schools. His *Logic*, published in 1766, was a major outcome of his philosophical inquiries and its manuscript version had already been widely used in the Greek schools of the Balkans. Apparently its printed form consolidated its authority and provided Voulgaris with wider acknowledgment. But, surprising as it may sound, he did not continue with the publication of his already completed translations and original natural philosophical treatises. He preferred to translate and publish a rather complicated mathematical work, written by the Hungarian mathematician Johann Andreas von Segner (1704–1777). Although in the course of time the book gained some recognition in Greek education, when it was first published Voulgaris' contemporaries perceived it as an ostentatious exercise on his part.[33] It seems, though, that Voulgaris' plans involved more complicated calculations.

The reason he preferred Segner's *Elementa arithmeticae et geometriae* to his ready philosophical works relates to the fact that upon his arrival in Leipzig he started building a new network of patrons who would lead his career outside the limits of the Ottoman Empire. Voulgaris' *nation* was not Greece; it was Orthodoxy. And the most promising leader of the emerging (out of the Ottoman Empire's decay) Orthodox world was Catherine II. Segner, with whom Voulgaris got connected with close friendship soon after his arrival in Leipzig, was part of the network that could introduce him to the Empress' circles. A professor at Göttingen and, later, in Halle, he had received important awards for his scholarship, some from Frederick the Great himself. When some years later Voulgaris departed for Catherine's court, Segner provided him with a letter of recommendation addressed to his friend Leonard Euler (1707–1783), a renowned member of Saint Petersburg Imperial Academy.[34]

Thus, it seems that while in Leipzig, Voulgaris developed a double strategy concerning his future steps. On the one hand he still kept an eye on his former career in Greek education and the patronage system on which he relied. The publication of the two textbooks and the devotion of his *Logic* to his former patron Gregorios Ghikas (1724–1777) provide evidence in support of this strategy. On the other hand, though, he had started carefully elaborating the possibility of an *exodus* towards the Russian court. As we already saw, the choice of Segner hid a

[33] Άλκης Αγγέλου (ed.), *Ιωσήπου του Μοισιόδακος, Απολογία* [*Apologia of Iosipos Misiodax*] *(*Athens: Ερμής, 1992), pp. 42-43.

[34] Stephen K. Batalden, *Catherine II's Greek Prelate. Eugenios Voulgaris in Russia, 1771-1806* (New York: Columbia University Press., 1982), p. 15.

certain calculation. The choice of Voltaire most probably hid the same calculation to the extent that Voulgaris used him (and his relationship with the Empress) to discuss Catherine's role in the emerging Orthodox *nation*.

While in Leipzig, Voulgaris displayed a variety of intellectual interests reflected in the variety of his publications. Voltaire also served him in launching a thread of philological work, which proved crucial in the later phases of his career. So, a couple of years before the work on religious tolerance, Voulgaris had also published his rhymed translation of Voltaire's short story *Memnon ou la sagesse humaine* (originally published in 1749). But, quite surprisingly, the work, which eventually marked his new orientation, was a legal code. Around 1770, Voulgaris met the Orlov brothers (Grigory Grigoryevich Orlov, 1734–1783 and Alexei Grigoryevich Orlov, 1737–1808), Catherine's military courtiers, who had prepared at that time an uprising of the Ottoman Empire's Christian populations. Through them Voulgaris became aware of the Empress' desire to have her *Nakaz* translated into Greek. *Nakaz* was Catherine's plan for the new legal code she wished to put into effect in the new Russian Empire that would result from the Russian–Ottoman wars. Voulgaris not only translated the *Nakaz* (from French) but he also enriched it with a preface addressed to the Greek-speaking Orthodox populations of the Ottoman Empire. Making clear his translation's political intentions he not only praised the virtues of enlightened despotism, but also described Catherine the Great as the mother who would unite under her auspices the Orthodox *nation* irrespective of the *ethnic* differences between the various populations.[35]

Eastwards

Voulgaris' well-paid translation was published in St Petersburg in 1771. The real pay-out of his work, however, was the invitation he received from Catherine to join her intellectually thriving court. At last, his search for a new patronage network came to an end. Provided with Segner's recommendation letter he moved, that same year, to St Petersburg hopefully to resume his scientific work, which he had set aside during the uncertain Leipzig period. Until that time Voulgaris had produced his major natural philosophical works, which enjoyed wide reception by the Greek schools of the Balkans. However, all these works had for a long time remained in manuscript form and it is quite plausible to suppose that during his stay in Leipzig he planned

[35] Άλκης Αγγέλου, *Των Φώτων Β΄: Όψεις του Νεοελληνικού Διαφωτισμού* [*Of the Lights, B: Aspects of the Neohellenic Enlightenment*] (Athens: Μορφωτικό Ίδρυμα Εθνικής Τραπέζης, 1999), pp. 68-69; Batalden, *Catherine II's Greek Prelate*, p. 29.

to prepare them for the press. But the uncertainties of his search for a new patronage scheme and the unexpectedly successful *finale* left his project incomplete. As we shall see, and most probably as Voulgaris himself wished, the conclusion of the project would take place in the new environment but much later than he had hoped.

Voulgaris spent the rest of his life in Russia. He travelled within the Empire, but never went back to Central Europe or to the Greek-speaking regions of the Ottoman Empire. One important development soon after his arrival in St Petersburg was his quick ascension to the office of Archbishop of Slavensk and Kherson; the Russian Orthodox Patriarchate created the new diocesan seat especially for him. In 1776, he travelled to Poltava to undertake the running of the diocese and to supervise the establishment of the Greek-speaking populations, who had moved there after the unsuccessful uprising in the Peloponnese incited by the Orlov brothers. Due to political disagreements, he resigned three years later but remained in the area, most probably to support his close friend and successor Nikiphoros Theotokis (1731–1800). In 1781, he was ordered to move to Kherson to settle a riot of the Greek-speaking populations against the Russian state. According to all the evidence, he stayed in Kherson until the late 1780s, when he returned to St Petersburg to spend the rest of his long and prolific life.[36]

Although during his second career in Russia Voulgaris seemed to have abolished his scientific interests, we should not mistake his difficulty to deal with such issues for lack of genuine interest. There are at least three instances that testify to the contrary. Firstly, we remember that when he left Leipzig, he took advantage of his friendship with Segner to obtain a recommendation letter to the famous mathematician Leonard Euler. It seems that his initial idea was that in St Petersburg he would be able to further his scientific pursuits in the fertile environment of the famous local academy. Presumably, he did not manage to realize this ambition, or at least it is unknown to what extent he managed to do so. But we do know (and this is the second instance attesting to his interest in the sciences) that in 1776, the same year he departed for Poltava, he was elected *in absentia* as an honorary member of the Russian Academy of Sciences.[37] The third instance is an enigmatic one, the exact circumstances of which it has been difficult, so far, to trace. In 1788, and while he was still in southern Ukraine, he was

[36] A detailed exposition of Voulgaris' life and travels in the Russian Empire in Batalden, *Catherine II's Greek Prelate.*

[37] Batalden, *Catherine II's Greek Prelate*, p. 63. Important detail: Voulgaris was notified about the election by Johann Euler (1734–1800), Leonard Euler's eldest son, also a famous mathematician and astronomer, and a member of St Petersburg Academy himself.

elected a foreign member of the Royal Society of London – when the president of the society was Sir Joseph Banks (1734–1820).[38]

So, Voulgaris was beyond doubt an acknowledged "man of science". Moreover, all three instances provide evidence for his intention to remain active in this area, as it would be difficult to believe that his designation as a member of the Russian Academy and of the Royal Society of London would have happened without his incitement. However, during the years he spent in Russia, Voulgaris did not produce any scientific work. Before his departure for Poltava, he mainly translated and composed a number of short political treatises, intending to promote Catherine's image as an Enlightenment persona and as a powerful ruler guaranteeing the post-Ottoman European distribution of power.[39] While in Poltava, he turned his attention, once again, toward religious issues, apparently related with the ideological consolidation of the Greek-speaking populations who had moved there. At the same time, he established a Greek school assigning its directorship to his future successor Nikiphoros Theotokis. Theotokis, like Voulgaris, had been a renowned teacher of natural philosophy and mathematics. After a journey quite similar to Voulgaris' own in Eastern and Central Europe, Theotokis settled at Catherine's court and joined Voulgaris' project. While Theotokis was dealing with teaching, Voulgaris translated into Greek Feofan Prokopovich's (1681–1736) *Spiritual Regulation*, the guiding text of the Russian Holy Synod. *Spiritual Regulation,* among other things, discussed issues of jurisdiction of the Russian Patriarchate over the Orthodox lands gained by the Russians from the Ottoman Empire. The text was eventually published in 1916, bearing witness, on the one hand, to the uninterrupted contemporaneity of such issues, and on the other, to Voulgaris' prophetic understanding of Russian expansionism.[40]

When Voulgaris moved to Kherson he resumed the philological interests he had initiated through Voltaire's translations in Leipzig. This time, however, he turned to Roman antiquity, translating Virgil's *Georgics*. The translation was eventually published in 1786 and was devoted to the powerful man of Novorosiya and Catherine's protégé Grigorii Potemkin (1739–1791) as part of Voulgaris' attempt to gain his support for the revival of the Greek communities

[38] Γεωργία Πέτρου, "Ο Ευγένιος Βούλγαρης (1716–1806) και η Βασιλική Εταιρεία του Λονδίνου" ["Eugenios Voulgaris (1716–1806) and the Royal Society of London"], *Νεύσις*, 2001, 10: 181–198. As far as is known Voulgaris was the first Greek elected a member of the Royal Society.

[39] Batalden, *Catherine II's Greek Prelate*, p. 29 and note 71. According to all the evidence, these translations were commissioned by Catherine herself.

[40] Batalden, *Catherine II's Greek Prelate*, pp. 45-46.

in the Russian Empire.[41] At the same time, though, through Virgil's translation Voulgaris prepared his return to St Petersburg. The so-called Russian classicism was an important dimension of the city's intellectual life and, when Voulgaris returned there, in 1789, he was already well integrated into it. Two years later, the Russian Academy published his translation of Virgil's *Aeneid*. The poem narrates the adventures of Aeneas after the Trojan War, providing an illustrious historical background for the Roman Empire; but it is highly improbable that Voulgaris had *that* empire in mind when addressing his translation to a Greek-speaking audience with the eulogies of the Russian state.[42] During the last years of his life, along with some religious translations and some historical writings, Voulgaris attempted his first translation from Greek to Russian. He translated word for word Anacreon's poems and subsequently Nikolai Aleksandrovich L'vov (1751–1803) gave them poetical form. The outcome of this unusual cooperation was published in 1794 and had a deep impact on the Russian poetry of the time, which had already made extensive use of the Anacreontic ode's pattern.[43]

Being undoubtedly until the end of his life a 'man of science", Voulgaris had been, however, indulging for a long time into theology, philology and above all politics. It would thus be reasonable to assume that his impact on Greek scientific life was pretty limited. But, quite surprisingly, this was not the case. And it is especially important to notice that *it was the development of his particular profile, as a leading political and religious figure, that awarded his scientific work its special significance*. Voulgaris' works retained an outstanding position in the Greek scientific and philosophical education of the eighteenth and the early 19th centuries. Most of them remained until quite late in manuscript form, but were widely reproduced all the time. As we already saw, Voulgaris was considered the most important educational renovator of the eighteenth century, the philosopher who effectively helped Greek intellectual life overcome the restrictions of the neo-Aristotelian natural philosophy. And, most importantly, the most renowned scientifically minded scholars of the eighteenth and the early nineteenth centuries, even those who opposed him, were proud to state that they had studied under him in Jannina, in Mount Athos, or in Constantinople.

[41] Batalden, *Catherine II's Greek Prelate*, p. 72

[42] Αγγέλου, *Των Φώτων Β΄, pp.* 248-249; Batalden, *Catherine II's Greek Prelate*, p. 80.

[43] Batalden, *Catherine II's Greek Prelate*, pp. 81-82.

Conclusion of a career

Voulgaris, through his career and his recognition by the patrons of the Enlightenment, became a kind of symbolic figure. Indeed, what made Voulgaris especially representative of his time was his function as an intermediate individual. He crossed (*he travelled through*) a variety of social environments bridging different philosophical and political visions. In the realm of philosophy and the sciences he assimilated the attainments of the Enlightenment in his native neo-Aristotelian context depriving them from their inherent empiricism, but linking them with the major stake of securing the unity and the continuation of philosophy. In the realm of politics he linked his native cultural heritage with the vision of an Orthodox empire, where the Greek culture and language would enjoy a distinctive position. In the realm of religion, finally, he joined his Orthodox faith with both his philosophical and his political concerns. On the one hand, he attempted to revive the religious dimension of natural philosophy by linking the traditional philosophical views of Nature with his contemporary natural theology; on the other, he crossed the borders between two different Churches in order to achieve a higher degree of state-guaranteed integrity for his Orthodox faith. After all, it was this highly intermediate state that allowed Voulgaris to best express the intellectual and political ambiguities of the emerging Greek society.

In this respect, it is hardly surprising that in 1805, being almost 90 and just one year before his demise, he saw all the major natural philosophical works he had compiled or translated between 1742 and 1762 going to press. The publication of most of them was funded by a family of rich merchants and was intended for free delivery to the Greek-speaking students of the Balkans. We are in a position to know that the members of Zosima family were not the first who attempted to convince the aged scholar to present the *nation* with his philosophical syntheses. Voulgaris had resisted another similar proposal some ten years earlier, but it seems that approaching the end of his life he became more compromising.[44] What is more important, however, is that there were, indeed, people who insisted on the publication of his scientific and philosophical works considering them important for the consolidation of contemporary Greek culture. As soon as Voulgaris stopped traveling, his works started inscribing their own trajectories on the intellectual firmament, contributing to the formation of a national

[44] Κούμας, *Ιστορία των Ανθρωπίνων πράξεων*, p. 563, note 2.

consciousness, undoubtedly beyond the intentions of Voulgaris himself, but in accordance with the expectations of the social groups, who gradually got the lead of the emerging Greek society.

Observatories, instruments and practices in motion: an astronomical journey in the nineteenth-century

Pedro M. P. Raposo[*]

Abstract

This paper addresses the establishment and development of the Astronomical Observatory of Lisbon (AOL). It focuses on some aspects of a journey made by its first astronomer and director, Frederico Augusto Oom (1830–1890) who, between 1858 and 1863, visited several observatories and instrument workshops in Europe, and spent long periods studying and practising at the Observatory of Pulkovo in Russia. This case is used to illustrate how a specific site of knowledge can be approached as an open and dynamic embodiment, the constitution and development of which interconnects several actors and spaces through a wide array of practices and interactions. For that purpose, the AOL is contextualized in a broad space of circulation of observatory plans, management styles, instruments and practices that ultimately connected the networks and circuits of nineteenth-century European astronomy with the geography of the Portuguese overseas empire.

1. Introduction: "saudade" and an astronomical mission

On 24 August 1858 Frederico Augusto Oom (1830–1890), a young Sub-Lieutenant of the Portuguese War Navy, left Lisbon heading for the Observatory of Pulkovo near St. Petersburg (Fig. 1), as an envoy for the Portuguese government. In a sort of a travel journal, Oom sought to pen down the mixed feelings he experienced as he saw the Portuguese capital vanishing behind the ship that carried him away. On the one hand, Oom got immersed in a blend of "saudade" (nostalgia) and insecurity: he had been sent away from his loved ones to a remote place, in a mission expected to last several years, which he was not sure of being capable of accomplishing with success. On the other hand, he was enthused by the prospects of attaining a respectable social status, securing a good income, and then a family. He could not keep dark thoughts at bay though. In a fatalistic tone, Oom added in his notes that there was always a

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good solution to put an end to one man's troubles, whatever those troubles were: a revolver plus a "sphere of Pb" (a sphere of lead).[1]

Fig. 1 – The Observatory of Pulkovo in the nineteenth-century.
(F. G. Wilhelm Struve, *Description de l'observatoire astronomique central de Poulkova*, 1845)

The anguish of the envoy contrasted with the enthusiasm of the Portuguese dignitaries who had sent him to Russia. The year before, Pedro V, the King of Portugal,[2] had given his patronage to the foundation of a new observatory in the Portuguese capital.[3] This undertaking counted on the enthusiastic support of Wilhelm Struve (1793–1864), the director of the Observatory of Pulkovo.[4] Struve was widely recognised as a skilful astronomer, and Pulkovo hailed as the most sophisticated observatory in the world. Pulkovo hosted out extensive programmes of stellar observations that resulted in new stellar catalogues and in refined values for the fundamental constants of astronomy.[5] However, Struve and his great observatory were not able to provide a convincing response to one of the most vexing problems of practical astronomy: the measurement of stellar distances by the method of trigonometric parallax, that is, by measuring the apparent annual shift in the position of a star due to the orbital motion of the Earth. It is well known that, in the late 1830s, Wilhelm Struve, Friedrich Bessel (1784–1846)

[1] Frederico Augusto Oom, untitled and undated manuscript, Archive of the Astronomical Observatory of Lisbon – MUHNAC (henceforth Archive of the AOL), A576.

[2] On the life and reign of Pedro V see Maria Filomena Mónica, *Pedro V* (Lisboa: Temas e Debates, 2007).

[3] There was already an observatory in Lisbon, the Royal Observatory of the Navy, but it was actually a makeshift arrangement of a poor set of instruments installed at the Navy Arsenal. On this observatory, see António Estácio dos Reis, *Observatório Real da Marinha* (CTT- Correios de Portugal, 2009).

[4] On the early history of the Observatory of Pulkovo, and on the lives and works of its first directors W. Struve and Otto W. Struve, see: Alan Batten, *Resolute and undertaking characters: the lives of Wilhelm and Otto Struve* (Dordrecht: D. Reidel Publishing Company, 1987), and "The Struves of Pulkovo – a family of astronomers", *The Journal of the Royal Astronomical Society of Canada* 71, 1977: 345-372; Adam J. Szander, "F. G. W. Struve (1793-1864): astronomer at the Pulkovo Observatory", *Annals of Science* 28, 1972: 327-346.

[5] Kevin Krisciunas, "Pulkovo and the National Observatory movement: an Historical overview", in: J. H. Liske, V. K. Abalakin (eds.), *Inertial Coordinate System on the Sky* (IAU, 1990), pp. 29-38.

and Thomas Henderson (1798–1844) presented the first consistent results for the measurement of stellar parallax.[6] What is usually overlooked is that these results were nonetheless surrounded by doubt, and that the aforementioned astronomers were themselves convinced that the methods involved in such measurements were still in need of further discussion and improvement.[7]

A controversy on stellar parallax measurements with the French astronomer Hervé Faye (1814–1902) had led Wilhelm Struve to recognise Lisbon as an optimal place to foster stellar astronomy.[8] Several stars deemed suitable for parallax measurements crossed the zenith of the Portuguese capital, or passed close to it. They could thus be observed with minimal effects from atmospheric refraction. Moreover, the dark summer nights of Lisbon would favour the observation of nebulae, whose nature was under debate. And generally, the mild Portuguese climate should provide plenty of occasions of good visibility.[9]

Struve was thus convinced that the stellar realms could be efficiently scrutinized in Portugal. He wanted Pulkovo to secure the international leadership in stellar astronomy (or, in coeval parlance, "sidereal astronomy"). If there was a possibility of setting up a new observatory afar, able to further this yet incipient field beyond what was feasible in Pulkovo, then it should better have a close relation with the Russian observatory. Consequently, Struve made himself available to advise the Portuguese authorities on all technical and organisational matters concerning the future Astronomical Observatory of Lisbon (henceforth AOL).

The Portuguese authorities were receptive to Struve's advice. The first decades of the nineteenth century had been rather turbulent in Portugal, with the Napoleonic invasions and the move of the Portuguese court to Brazil, then the civil war between liberals and absolutists, and, after the official implementation of a liberal monarchy in 1834, the frequent conflicts between the conservative and progressive sects of the new regime.[10] In 1851, a coup d'état known as Regeneração gave way to a period of political and social pacification, marked by a focus on the modernisation of the country through major programmes of infrastructural

[6] J. D. Fernie, "The historical search for stellar parallax", *Journal of the Royal Astronomical Society of Canada* 69, 1975: 153-161, 222-239; 70, 1976: 40. For a broader historical contextualization see Michael Hoskin, *Stellar Astronomy. Historical studies* (Bucks: Science History Publications, 1982).

[7] Pedro M. P. Raposo, "The quest for stellar parallax in the nineteenth century, the 'astronomical capital of the world' and the foundation of the Observatory of Lisbon", in: Luís Saraiva (ed.), History of Astronomy in Portugal. Institutions, Theories, Practices (Porto: Sociedade Portuguesa de Astronomia, 2014), pp. 241-264.

[8] *Ibidem*.

[9] W. Struve to Lobo de Moira, 30 June 1857, translation (French to Portuguese), in "Acta da Sessão de 28 de Novembro de 1857", Archive of the AOL, FO17.

[10] Maria de Fátima Bonifácio, *Uma história de violência politica. Portugal de 1834 a 1851* (Lisboa: Tribuna da História, 2009); *O século XIX português* (Lisboa: Imprensa de Ciências Sociais, 2002).

enhancement (roads, telegraphs, railways, etc.).[11] These programmes were motivated not only by the wish to bolster the economy, but also by a strong concern with the external image of the country. King Pedro V was particularly sensitive to these aspirations. Prior to his coronation, he went on two European journeys in order to appreciate the realisations of material progress abroad.[12] A visit to the Observatory of Brussels in 1854, in the context of these travels, convinced him that the absence of a proper observatory in Lisbon was a motive for national shame.[13]

It was thus extremely convenient that Wilhelm Struve was interested in Lisbon. Pedro V eventually entrusted Filipe Folque (1800–1874),[14] his former tutor in mathematics, the head of the Portuguese geodetic surveys, and a member of the King's entourage in his European travels, with the foundation of a new observatory. This assignment included taking care of the liaisons with Struve and other foreign astronomers. As the main scientific advisor of the undertaking, Struve recommended that at least one apprentice was sent to Pulkovo in order to learn and practise the techniques of precise astronomical measurement. The envoy was also expected to visit and study the facilities, instruments and administration of other observatories, and to call at instrument workshops. Frederico Augusto Oom, a former student of Filipe Folque at the Polytechnic School of Lisbon (where the latter held the chair of Astronomy and Geodesy) was the chosen one. His mission, which was to last for five years, was expected to render a skilful observer, and above all an advanced observatory. In fact, more than a training and fact-finding mission, it would be an observatory-making journey.

The first two years of Oom´s mission are relatively well documented; the remainder of it, not so much. Nevertheless, the available sources suffice to provide an insight on the encounters, interactions and activities entailed in the mission, and on how it developed in tandem with the inception of the AOL. Oom´s journey can thus be used to look into the interplay between mobility, displacement and circulation in the making of a specific site of knowledge, in this case an observatory.

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[11] António José Telo, "O modelo político e económico da Regeneração e do Fontismo (1851-1890)", in: João Medina (ed.), *História de Portugal – dos tempos pré-históricos aos nossos dias,* Vol. XI (Amadora: Ediclube, 2004), pp. 115-156; José Miguel Sardica, *A Regeneração sob o Signo do Consenso – A Política e os Partidos entre 1851 e 1861* (Lisboa: Imprensa de Ciências Sociais, 2001); Maria Filomena Mónica, *Fontes Pereira de Melo* (Lisboa: Aletheia, 2009).

[12] Filipa Lowndes Vicente, *Viagens e Exposições – D. Pedro V na Europa do Século XIX* (Lisboa: Gótica, 2003).

[13] Pedro V/Academia das Ciências de Lisboa, *Escritos de El-Rei D. Pedro V coligidos e publicados pela Academia das Sciências de Lisboa*, Vol. I (Coimbra: Imprensa da Universidade, 1922), pp. 196-197.

[14] On Filipe Folque see: Luís Miguel Carolino, "Measuring the Heavens to Rule the Territory: Filipe Folque, the Teaching of Astronomy at the Lisbon Polytechnic School and the Modernization of the State Apparatus in Nineteenth Century Portugal", *Science & Education* 21, 2012: 109-133; Rui Branco, *O mapa de Portugal. Estado, Território e Poder no Portugal de Oitocentos* (Lisboa: Livros Horizonte, 2003); Maria Clara Pereira da Costa, *Filipe Folque (1800-1874) – o homem e a obra. O diário da sua viagem à Europa integrado no séquito de D. Pedro V, alguns ofícios e cartas particulares* (Lisboa, 1986).

The history of observatories has been given a great impulse by an approach based on the concepts of "observatory sciences" and "observatory techniques". This approach seeks to capture not only how observatories functioned in the context of wider political, socio-economic and epistemic contexts, but also how the latter were themselves shaped by observatory practices.[15] Yet, observatories are still approached, to a significant extent, as reified and circumscribed entities, serving essentially as stage, scenario and point of passage for the development of such practices. This is possibly a reflection of a less-accomplished aspect of the so-called "spatial turn" in the history of science. The spatial turn was certainly important in that it led historians to turn their attention to the local specificities of knowledge practices and to the geographical nuances of knowledge production, dissemination and appropriation.[16] However, specific spaces of knowledge have often been approached in a somewhat static and descriptive way, in the sense that the focus is placed on their arrangement and configuration in a certain historical moment, and on what happened inside, through and around them. But how did such spaces themselves evolve? What kinds of knowledge practices were involved in their design, construction and reconfiguration? How does the formation of a specific site of knowledge relate to other sites, and what kind of exchanges and mediations take place between them? What happens to practices, skills, instruments and research programmes in these processes?

This paper aims to address these questions by following Frederico Augusto Oom in his astronomical journey through mid-nineteenth century Europe. By doing so, I intend to show that a specific site of knowledge may be regarded as a dynamical embodiment the configuration of which changes with time, and the development of which entails a wide array of interactions involving several other spaces and locations.

It has been remarked that embodiments are multivalent; they can entail and represent a wide range of meanings, skills, and processes, as they can also trigger challenges and invitations.[17] They involve people and objects alike, human and non-human entities. To understand how scientific practices develop through a multitude of embodiments, we must follow and study people as well as instruments, books, samples, letters, buildings and many

[15] David Aubin, Charlotte Bigg and H. Otto Sibum (eds.), *The Heavens on Earth - Observatories and Astronomy in Nineteenth Century Science and Culture* (Durham, North Carolina: Duke University Press, 2010).

[16] See, for instance: Charles W. J. Withers, "Place and 'spatial turn' in geography and history", *Journal of the History of Ideas* 70, 2009: 637–658; Diarmid A. Finnegan (2008) "The spatial turn: geographical approaches in the history of science", *Journal of the History of Biology* 41, 2008: 369–388; David Livingstone, *Putting science in its place: geographies of scientific knowledge* (Chicago: University Press, 2003); Stephen J. Harris, "Long-distance corporations, big sciences, and the geography of knowledge", *Configurations* 6, 1998: 269–304; Steven Shapin, "The house of experiment in Seventeenth-Century England, *Isis* 79, 1988: 373-404.

[17] Lissa Roberts, "The Circulation of Knowledge in Early Modern Europe: Embodiment, Mobility, Learning and Knowing", *History of Technology* 31, 2012: 47-68.

other entities. However, following people is probably the best way of capturing the interplay between all of these entities, as well as to analyse how this interplay is framed by specific agendas and research programmes, and to scrutinize the different meanings and representations they involve.

This is the approach I seek to develop here. I will begin by pointing out the constitutive character of travels in the making of observatories, and by emphasizing their importance in the establishment of the Observatory of Pulkovo. Then I proceed to illustrate how the AOL, as an evolving project, was set in motion between Lisbon and St Petersburg through Oom's travels. For that purpose, I shall focus on some specific episodes of Oom's visits to instrument workshops and meetings with instrument makers, on activities he performed as a trainee astronomer in Pulkovo, on his participation in an eclipse expedition, and on encounters he had with other astronomers in different observatories. Finally, I address the AOL in place: the actual Astronomical Observatory of Lisbon, as it became embodied on the slope of a hill facing the River Tagus; the transformations it underwent; and how such transformations relate to Oom's journey.

2. The "Astronomical capital of the world", its roots and circuits

The Observatory of Pulkovo was inaugurated with pomp and circumstance in 1839. It was lavishly funded by Tsar Nicolas I, who, after entrusting Wilhelm Struve with its foundation, gave him "carte blanche" to spend as much as necessary in order to obtain the best available instruments. The observatory's building was designed as a cruciform complex, consisting essentially of a central block with wings radiating to the south, east and the west (Fig. 2).[18] The east and west wings also had extensions to the north, each topped by a revolving dome. A similar but bigger dome topped the central body and housed a 15-inch refractor by Merz & Mahler, the largest instrument of its kind in the world until the 1870s. The other fixed instruments included an Ertel vertical circle and a transit instrument by the same maker (both installed in the west wing); a Repsold transit instrument in the prime vertical (installed in the south wing); a transit circle also by Repsold (in the east wing); and a heliometer by Merz & Mahler (in the small dome in the east wing). Comet seekers, portable instruments for astronomical and geodetic observations, small telescopes, clocks, chronometers and auxiliary

[18] For a full description of the Observatory of Pulkovo in its original form see F. G. Wilhelm Struve, *Description de l'observatoire astronomique central de Poulkova* (St. Pétersbourg: Imprimerie de l'Académie Impériale des Sciences, 1845).

devices such as a level examiner, thermometers and barometers completed a collection that showcased the state-of-the art of astronomical instrumentation. This sumptuous collection of instruments was complemented with a vast and equally magnificent library. Completeness was valued as much as the practical needs of scientific work. For instance, in a description of the heliometer, Struve acknowledged that, six years after the inauguration of the observatory, the instrument remained unused. Priority was given to other instruments, but the heliometer was an improved version of the instrument employed by Bessel in stellar parallax measurements. Thus, Struve asserted, it had to be included in Pulkovo´s equipment.[19]

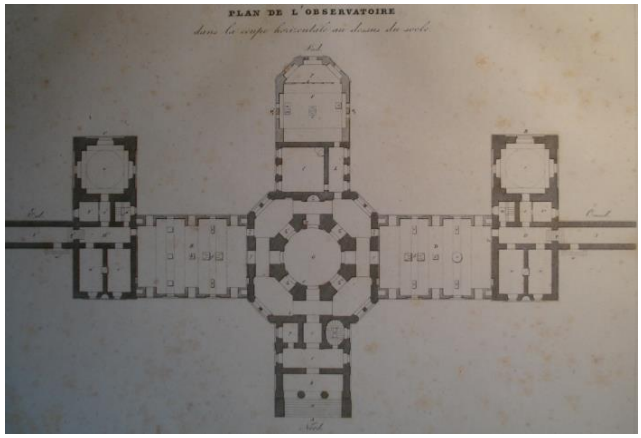


Fig. 2 – Plan of the Observatory of Pulkovo.
(F. G. Wilhelm Struve, *Description de l'observatoire astronomique central de Poulkova,* 1845)

The Observatory of Pulkovo was embedded in the culture of theatricality that pervaded Tsarist Russia.[20] It constituted a spectacle of big science, affirming the commitment of the Russian empire to scientific endeavour[21] in contrast with its external image of a fearsome and backward 'gendarme of Europe'.[22] The observatory soon started to attract prominent members of the international astronomical community. By the time Frederico Augusto Oom left Lisbon bound to Pulkovo in August 1858, the Central Observatory of Russia (as it was also known) had already been visited by Heinrich Christian Schumacher (1780–1850) of the Altona Observatory, the Astronomer Royal George B. Airy (1801–1892) of Greenwich, and G. P. Bond (1825–1865) of the Harvard College Observatory in Massachusetts, U.S.A, among

[19] *Ibidem*, p. 203.

[20] Simon Werrett, "The Astronomical Capital of the World: Pulkovo Observatory in the Russia of Tsar Nicholas I", in David Aubin, Charlotte Bigg and H. Otto Sibum (eds.), *The heavens on Earth…*, pp. 33-57.

[21] Mari Williams, "Astronomical Observatories as Practical Space: The Case of Pulkowa", in Frank A. J. L. James (ed.), *The Development of the Laboratory - Essays on the Place of Experiment in Industrial Civilization* (Hampshire and London: The MacMillan Press, 1989), pp. 118-135.

[22] W. Bruce Lincoln, *Nicholas I: Emperor and Autocrat of All the Russias* (Northern Illinois University Press, 1989), pp. 239-252.

others. Physical distance did not deter these astronomers from experiencing *in loco* what they perceived as the very embodiment of technical prowess in astronomy. The Central Observatory of Russia would keep on attracting prominent and less known visitors from all provenances. It was eventually dubbed the 'Astronomical Capital of the World'.[23]

But Pulkovo was by no means the only observatory to attract visitors. Throughout the nineteenth-century astronomers and practitioners in other fields got increasingly involved in international tours of places relevant to their specialities –observatories, museums, universities, laboratories, instrument workshops, and others. The traditional Grand Tour of noble education was thus assimilated into a new kind of learning and networking journey.[24]

The Central Observatory of Russia itself was, to a great extent, a product of the same processes of mobility. In 1834, when he found himself endowed with "carte blanche" from the Tsar, Wilhelm Struve knew where to find the advice and support he needed to set up the utmost observatory on Earth. Throughout his 25-year career as a professor of astronomy at the University of Dorpat (nowadays Tartu, Estonia), Struve had always been a keen traveller and a persistent networker, seeking to maintain close relations with the leading European astronomers and instrument makers of the day, especially those of the German lands.

His first assignment towards the establishment of the Central Observatory of Russia was precisely an observatory and instrument-workshop tour,[25] during which he discussed the plans for Pulkovo with prominent astronomers and craftsmen, such as: the already mentioned Friedrich Bessel, who was acclaimed as a master of precise astronomical measurement; Johan Encke (1791–1865), a renown observer based in Berlin; Bernhard August von Lindenau (1780–1854), formerly the editor of one of the first journals committed to astronomy and related sciences, known as *Monatliche Correspondenz*;[26] Heinrich Olbers (1758–1840), a medical doctor by training who became an authority in comets; Heinrich Christian Schumacher (1780–1850), editor of the important periodical *Astronomische Nachrichten*. Struve also maintained close contacts with other prominent mathematicians and astronomers such as Friedrich Gauss (1777–

[23] In his autobiography the astronomer Simon Newcomb (1835–1909) wrote: "I believe it was Dr. B. A. Gould who called the Pulkovo Observatory the astronomical capital of the world": Simon Newcomb, *The Reminiscences of an Astronomer* (Teddington: The Echo Library, 2007[1903], p. 149).

[24] For an overview of the role of travels in the making of knowledge, and some examples of tours such as those approached here but in fields other than astronomy, see: Ana Simões, Ana Carneiro, Maria Paula Diogo (eds.), *Travels of Learning. A Geography of Science in Europe* (Dordrecht: Kluwer Academic Publishers, 2003); Marie-Noëlle Bourguet, Christian Licoppe, Otto Sibum (eds.), *Instruments, travel and science: itineraries of precision from the seventeenth to the twentieth century* (London, New York: Routledge, 2002).

[25] F. G. Wilhelm Struve, *Description...*, p. 32.

[26] The full name of the journal was *Monatliche Correspondenz zur Beförderung der Erd- und Himmels-Kunde.* It preceded the *Astronomische Nachrichten* (mentioned below in the main text), which came to be one of the leading journals of astronomy in continental Europe, and which is still published nowadays.

1855) and Friedrich Argelander (1799–1875), whose advice he sought very frequently; and with instrument makers such as Carl von Steinheil (1801–1870) of Munich, the Ertel family (also of Munich), and the Repsold family of Hamburg.

Authorised by the Tsar to spend with no limits, relying on this network, and counting on the hard labour of Russian serfs, Struve would not have to wait for more than five years to see the Observatory of Pulkovo ready to be inaugurated. But there was more than spectacle about the observatory; through these contacts and exchanges, it was well grounded on the culture of precision that emerged in the German states over the first decades of the nineteenth century, whose main tenets were the commitment to rigorous measurement, the development of sophisticated instrumentation, and a thorough study and control of observational and experimental errors. This culture spurred the advancement of mathematical and physical sciences whilst providing the basis for modern administration and rationalised industrial production.[27]

Struve was careful in crafting the statutes of the Observatory of Pulkovo so that the Tsar agreed to commit it, primarily, to the advancement of astronomy. This allowed Struve to shape Pulkovo as the first national observatory dedicated to fundamental research.[28] In practice, it meant that Pulkovo would mainly seek to foster stellar astronomy on the grounds of precise measurement, namely by re-determining the fundamental constants of astronomy, and by measuring, as accurately as possible, stellar positions, the angular separation between components of double and multiple stars, and annual parallaxes.[29]

This required, among other things, that Pulkovo possessed first-class buildings and observation facilities, suitable for advanced scientific work. Struve's travels and contacts, together with his long experience as an astronomer at the Observatory of the University of Dorpat, allowed him to assemble a comprehensive synthesis of the foremost astronomical paraphernalia of the time. For example, the basic architectural shape of the Observatory of Pulkovo replicated a pattern that had become a common profile of astronomical observatories in the first half of the nineteenth-century, and which provided for a convenient distribution of

[27] Myles Jackson, *Spectrum of belief: Joseph von Fraunhofer and the craft of precision optics* (Cambridge - Massachusetts and London: MIT Press, 2000); Norton M. Wise (ed.), *The values of precision* (Princeton University Press, 1995); Katherine M. Olesko, *Physics as a Calling: Discipline and Practice in the Konigsberg Seminar for Physics* (Ithaca and London: Cornell University Press, 1991).

[28] Steven J. Dick, "Pulkovo and the National Observatory movement: an Historical overview", in J. H. Liske and V. K. Abalakin (eds.), *Inertial Coordinate System on the Sky* (IAU, 1990), pp. 29-38.

[29] F. G. Wilhelm Struve, *Études d'astronomie stellaire sur la Voie Lactée et sur la distance des étoiles fixes* (St-Petersburg: Imprimerie de L'Académie Impériale des Sciences, 1847).

workspace and instruments by the ground level and the upper floors.[30] Struve probably derived it from the observatories of Abo and Helsinki, where Friedrich Argelander had worked before moving to Bonn. Each of these observatories already incorporated other features adopted in Pulkovo, such as solid foundations for the piers supporting the instruments, and a large refractor. And Pulkovo´s much-envied 15-inch refractor (for several years, the largest in the world) was essentially a developed version of a famous 9-inch refractor made by Fraunhofer, which Struve had installed in Dorpat back in the 1820s. The revolving domes of the Observatory of Pulkovo also had the same design as the domes of the Dorpat Observatory. And the settings of its transit circle were based on those of the Berlin Observatory.

Pulkovo bore no striking resemblance to any of the abovementioned counterparts, but they all provided valuable elements and insights on issues such as the way to install the observational apparatus in order to achieve maximum precision, the architectural combination of residential and observing spaces, and the spatial organisation of the observatory as a workplace. Pulkovo was more about perfecting what already existed than about groundbreaking innovation.

It must be noted, though, that it was not a finished and closed showcase. In the *Description de l'observatoire astronomique central de Poulkova*, a detailed and lavishly illustrated, two-volume portrait signed by Struve himself,[31] and which the Russian authorities distributed to sovereigns and savants all over the world, the director of Pulkovo already pointed out several improvements that could be introduced in further versions of the apparatus presented in the book. Struve was not giving away his technical insights lightly: he was presenting Pulkovo as the template observatory to which all future astronomical endeavours should refer.

The AOL provided a convenient opportunity to produce a condensed and perfected version of Pulkovo, suited to excel in parallax measurements and other investigations in stellar astronomy. In order to make it state-of-the-art, it was imperative to travel again the circuits on which Pulkovo was grounded. Struve remained a keen traveller and would give a helping hand, using visits and journeys undertaken for other purposes to discuss some issues related to the Portuguese undertaking. However, if Oom was bound to become the first director of the AOL, then he should be able to do it on his own. And since it was, to a great extent, a matter of

[30] For an overview of the architecture of observatories see: Peter Müller, *Sternwarten in Bildern: Architektur Und Geschichte Der Sternwarten Von Den Anfangen Bis CA. 1950* (Berlin, Heidelber: Springer-Verlag, 1992); Marian Card Donnelly, *A short history of observatories* (Eugene: University of Oregon Books, 1973).

[31] See reference in note 18.

securing a sophisticated apparatus, it was very appropriate then that Oom began by visiting an instrument workshop.

3. An observatory in motion

3.1 At the workshop

Astronomers often called at instrument workshops or wrote to traders presenting ideas and requests the feasibility of which the craftsmen assessed on the grounds of their manufacturing experience. Preliminary tests and assessments were undertaken and discussed throughout the production process, especially when innovative designs or substantial modifications to previously existing instruments were involved.

This interaction between astronomers and craftsmen was framed by a tension between a gift economy and a commodity economy,[32] which pervaded the highly competitive business of advanced instrument making. Obviously, neither instrument makers were oblivious to profit, nor were astronomers amenable to give away all of their technical musings and insights for the financial benefit of others. Nevertheless, there could be substantial gains to both parts if their interests were efficiently negotiated, and if the outcome was sound: instrument makers augmented their repertoire, experience and prestige in the market, whereas astronomers got state-of-the-art instruments. Of course this was not always the case: instruments often proved faulty when put to work, and relations between users and suppliers could sometimes get sour.[33] But Wilhelm Struve had already established enduring relations with craftsmen such as the brothers Adolph Repsold (1806–1871) and Georg Repsold (1804–1867), who ran the firm founded by their father Johann Georg Repsold (1770-1830) some decades before.[34] By the time Oom went abroad, Wilhelm´s health was in decline, but his son Otto Struve (1819–1905), who also acted as an advisor to the Portuguese authorities, would maintain these liaisons as active and productive.

[32] Davis Baird, "Scientific instruments between making, epistemology, and the conflict between gift and commodity economies", *Society for Philosophy and Technology* 2, Summer-Spring 1997, http://scholar.lib.vt.edu/ejournals/SPT/v2n3n4/baird.html (accessed 8 July 2014).

[33] Simon Schaffer, "Easily Cracked: Scientific Instruments in States of Disrepair", *Isis* 102, 2011: 706-717; "The Bombay Case: Astronomers, Instrument Makers and the East India Company", *Journal for the History of Astronomy* 43, 2012: 151-180.

[34] In the period under focus here, the firm was named A. & G. Repsold. For an overview of its history see "Repsold, Johann Georg", Complete Dictionary of Scientific Biography, 2008, www.*encyclopedia.com* (accessed July 8, 2014).

The headquarters of the Repsold firm in Hamburg was the first official stop of Oom's mission, in September 1858.[35] The Repsolds had been commissioned the construction of the main instruments of the AOL.[36] These had been suggested by Wilhelm Struve and consisted of a transit circle, a transit instrument in the prime-vertical (the great circle at right angles with the celestial meridian), and a large equatorial refractor.

Oom was welcomed by Georg Repsold, who, after giving him a general tour of the premises, took the Portuguese envoy to see some components of the Lisbon meridian circle that had already been constructed. The transit circle had become the main observational instrument for cataloguing the heavens, that is, to measure accurately the coordinates of celestial objects.[37] In the Lisbon project, the transit circle had solely an ancillary role. It would be used to establish reference points for the stellar parallax investigations, and to determine local time. It was, nonetheless, carefully designed as an improved version of the transit circle of Pulkovo.[38]

As the future head of the AOL, Oom needed to master the anatomy and the inner workings of all of its major instruments. For the time being, as an apprentice, he would not have much input. But he was expected to oversee the manufacturing process, to check if everything went according to the plans ascertained between the Struves, the Portuguese authorities and the craftsmen, and to report on everything to Folque via mail. Oom was not only an astronomer in the making; he was also the eyes and ears of Folque and the other Portuguese dignitaries entrusted with the foundation of the AOL, amidst the international networks and circuits in which the new observatory was evolving.

Wilhelm Struve placed his greatest expectations on the prime-vertical instrument. He had used the Pulkovo´s prime-vertical (Fig. 3) to refine the values of the constants of aberration and nutation,[39] and believed that precise measurements of several stars in the prime vertical of Lisbon with a revamped instrument would give a decisive impulse to stellar parallax

[35] F. A. Oom to Filipe Folque, 17/29 September 1858, Archives of the AOL, FO18. Note that, at the time, Russia had not adopted the Gregorian calendar yet. Thus, the date for some letters cited in the remainder of the article is given in the old style/new style form, as in this case.

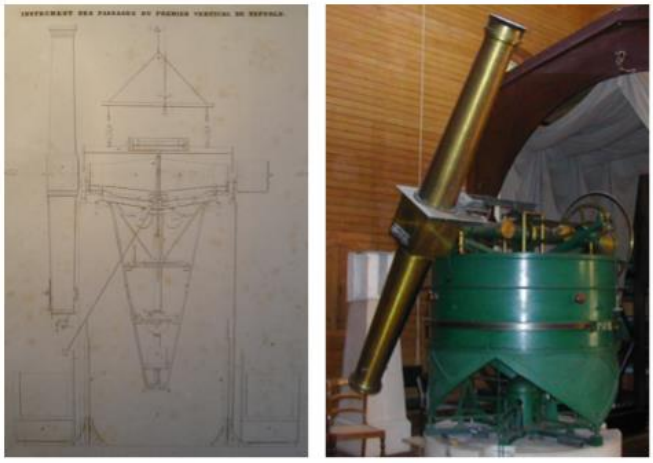
[36] The mechanical structures only; the optical elements (namely the objective lenses) would be supplied by the Merz and Steinheill firms.

[37] J. A. Bennett, *The divided circle: a history of instruments for astronomy, navigation and surveying*, (Phaideon, Christie's, 1987), pp. 174-177.

[38] The transit circle supplied to Lisbon was based on a similar instrument that the Repsolds had made for the Madrid Observatory in 1854, and in which they had had already introduced some improvements. One of the changes introduced had to do with the dimension of the circles (see fig. 12), which were smaller in the Madrid and Lisbon versions. It was assumed that the effects of flexure (bending by the effect of gravity) and temperature variations would be less significant for smaller circles (A. & G. Repsold to Folque, 26 April 1857, Archive of the AOL, C251).

[39] F. G. Wilhelm Struve, "Notice sur l'Instrument des passages de Repsold, établi à l'Observatoire de Poulkova dans le premier vertical, et sur les résultats que cet instrument a donné pour l'évaluation de la constante de l'aberration", *Astronomische Nachrichten* 20, 1843: cols. 257-262.

investigations. The new instrument (Fig. 4) was to be built only after the transit circle was completed, but the Repsolds had already assembled a tri-dimensional model, at the scale of 1/12, which they also presented to Oom. Models were especially useful in these preliminary stages, as they provided a basis to discuss and negotiate further modifications and improvements before actual production. The model that Oom saw at the Repsold warehouse already incorporated some changes indicated by Struve. They were essentially aimed at reducing the influence of mechanical errors in the observation, and at turning the instrument into a more versatile piece, adjustable to great circles other than the prime vertical. This last feature would increase the number of measurable stars.[40]



Figs 3 and 4 – Schematic drawing of the prime-vertical instrument of the Observatory of Pulkovo, and a redesigned version of the same instrument at the Observatory of Lisbon.
(F. G. Wilhelm Struve, *Description de l'observatoire astronomique central de Poulkova*, 1845, and Astronomical Observatory of Lisbon – MUNHAC, Museu Nacional de História Natural e da Ciência)

The model was then sent to Bonn Observatory, where Struve would call to discuss it with Argelander. Struve knew well that valuable insights and ideas came out of these conversations. In fact, the interaction between astronomers was as important as the exchange between astronomers and craftsmen, as far as the production of advanced instrumentation was concerned. Furthermore, Struve wanted to make sure that the revamped instrument, and the Lisbon project in general, garnered the support of his peers.

Struve was possibly disappointed to know that Argelander was not convinced by the prospects of measuring stellar parallax in the prime vertical. Argelander endorsed the construction of the instrument nonetheless, because it was, above all, an experiment in instrument design and observing techniques. After all, what did well-established astronomers

[40] Otto Struve to Filipe Folque, 2 July 1857, 23 January 1858, Archive of the AOL, FO17.

such as Struve and Argelander have to lose? The AOL would be located far away in the very western tip of Europe, and the Portuguese crown was putting the money in. If it succeeded, the merits would be theirs too; if it did not, the Portuguese would carry that burden. All they had to do was to steer it from afar and to assist Oom in his mission.

3.2 Placing the observatory from a distance

Despite this drive to explore new avenues, the experience accumulated in Pulkovo and other observatories was never to be overlooked. This applied not only to the building and the instruments, but also to the choice of the site where the AOL should be built. The Portuguese authorities initially considered some locations in Lisbon, conveniently close to the city's core, hence to the local centres of political and scholarly life. Struve had remarked on the importance of this proximity, but he equally underlined that the AOL should, at the same time, be distant enough to safeguard astronomers from the temptations of the capital. And above all, it had to provide stable ground for the main instruments, besides offering good visibility. None of the first suggested sites fulfilled these requirements.

King Pedro V eventually proposed that the observatory be built in Tapada da Ajuda, a royal estate used as a game park. Tapada was located in the outskirts of Lisbon, but within reach. And it faced the River Tagus, thus the observatory would feature as a landmark to those arriving in Lisbon or leaving the city by the river. Pedro V wanted it to be placed on the highest area of the park, but Peter Andreas Hansen (1825–1876) of the Gotha Observatory informed the Portuguese authorities that observations at the old building of this observatory, located on the top of a hill, had always been hampered by exposure to the wind.[41] The same could happen in Lisbon, he noted, if the AOL was placed atop Tapada. It was then decided that the AOL would be built further down, but another problem emerged: the soil was made of columnar basalt, a type of rock that tended to expand and contract with temperature variations.

The Portuguese authorities would not make a final decision without a seal of foreign authority. Since F. A. Oom was in transit, he would consult his expert interlocutors on this issue too. For that purpose, Tapada had somehow to go abroad with him. So it went, in the form of geological maps and a report commissioned from a professor of geology at the Polytechnic School of Lisbon.[42] This material was forwarded to F. A. Oom, who presented it to the

[41] "Acta da Sessão de 23 de Janeiro de 1858", Archive of the AOL, FO17.

[42] Francisco António Pereira da Costa, untitled and undated report, Archive of the AOL, C250.

Repsolds upon his first visit. They were used to assessing the stability of instruments; their opinion on this matter should be valued too. They approved the construction of the AOL further down in Tapada da Ajuda, but, careful as to the limits of their jurisdiction, recommended Oom to discuss the matter further with the astronomer Christian Peters. So did Oom, who, before reaching St. Petersburg, called at the Altona Observatory, where Peters, formerly an astronomer at Pulkovo, had moved. Peters warmly welcomed Oom. He keenly examined the charts and the report presented by the Portuguese envoy, and in the end gave his approval to the suggested site.[43] The Struves would have the final word, but they held the same opinion. It was thus decided that the AOL would be built on the slope of Tapada da Ajuda, roughly halfway from the top of the park.

Peters became an important advisor for the Lisbon project. He made himself available to oversee the acquisition of clocks and electro-chronographic devices from the Krille firm (later Knoblich), based in Altona. The Altona Observatory was to function as a checkpoint for these devices, which would be examined and tested there before their dispatch to Lisbon. As Oom was about to verify *in situ*, the Pulkovo astronomers were not particularly fond of electro-chronographic devices, preferring the old eye-and-ear method to the so-called American method.[44] However, several observatories in Europe had already adopted the latter, and the Portuguese authorities decided to adopt it too. It was then necessary to resort to other sources of expertise and advice on this particular matter. Nevertheless, Pulkovo continued to provide the main template for the AOL. Oom had to proceed to St. Petersburg.

3.3 Initiation at the 'Astronomical Capital'

Oom arrived in Pulkovo on 4 October 1858. Since Wilhelm Struve had fallen ill, Otto would supervise his apprenticeship. As an apprentice, Oom did not have immediate access to the main observing rooms. He would begin by working with a modest transit instrument supplied by the Ertel firm, which was placed in an external and small observation tower, usually reserved for apprentices and military officers practising to perform surveying work.

[43] F. A. Oom, untitled and undated manuscript, Archive of the AOL, A576; F. A. Oom to Folque, 17/29 September 1858, Archive of the AOL, FO18.

[44] The ear-and-eye method consisted of estimating the fraction of a second corresponding to the transit of a star or other celestial object by a reticule wire. In the American method, an electric chronograph was used to record both the signals from the clock, and the signals produced by the observer by means of a telegraphic switch. See Ian Bartky, *Selling the True Time* (Stanford: Stanford University Press, 2000), esp. pp. 32-44.

Oom found the Ertel instrument in a serious state of disrepair, serving essentially as a nest for invading flies. His task was to make it fit to determine time accurately, through observations of stellar transits. There was a long way to go. It was necessary to disassemble the instrument and to put it together again, to determine the angular distance of its reticule threads, to align it with the meridian, to adjust the illumination of the field of view, to check the piers of the instrument, and to clean the divided circles (besides, of course, removing the flies).[45] This was the gist of practical meridian work, which any serious professional astronomer should master before engaging in higher scientific pursuits. If Oom was bound to direct a great observatory, connected to the "astronomical capital of the world", he ought to be equally at ease with a small transit instrument in a narrow observation tower, and with a great equatorial or prime vertical-instrument inside a fancy astronomical building. After all, Wilhelm Struve himself had performed similar operations early in his career, at the Observatory of the Dorpat University.[46] In Pulkovo, astronomers were supposed to be dexterous practitioners, not only learned gentlemen.

Moving around narrow spaces, fixing things by making the best use of what was at hand, upholding the scientific acumen with a clear objective in mind, and enduring adversity, none of this should be strange to a naval officer like Oom, who had experienced long periods embarked on the near-obsolete vessels of the Portuguese War Navy. Such a background surely helped to alleviate the hardships of becoming an astronomer in a place like Pulkovo, where, as Oom later wrote to Folque, in wintertime, temperatures could drop to the point of the telescope tube damaging the skin of the astronomer if he touched it carelessly.[47]

Fortunately for Oom, not all work involved such a level of physical strain and risk. A substantial part of his apprenticeship consisted of theoretical studies and computing work. Oom had been instructed in Portugal to study practically every topic of coeval astronomy, side-by-side with learning the craft of precise observation. He was particularly expected to learn the method of least squares. This is a statistical tool of paramount importance to deal with random errors of observation,[48] which, by then, was still absent from the teaching and practice of astronomy in Lisbon. Oom learnt it in earnest, applying the method to observations carried out in Pulkovo with the transit circle, and to sets of data concerning comparison stars used in the

[45] F. A. Oom to Filipe Folque, 2 February/22 January 1859, Archive of the AOL, FO18.

[46] Alan H. Batten, *Resolute and undertaking characters*, p. 18.

[47] F. A. Oom to Filipe Folque, 22 January/2 February 1859, Archive of the AOL, FO18.

[48] Zeno G. Swijtink, "The Objectification of Observation: Measurement and Statistical Methods in the Nineteenth Century", in: Lorenz Kruger, Lorraine Daston, Michael Heidelberger (eds.), *The Probabilistic Revolution. Volume I: Ideas in History* (Cambridge, Massachusetts and London: MIT Press, 1987), pp. 261-285, esp. p. 262.

observation of planets and asteroids. The German way of doing astronomy required the practitioner to be not only a proficient observer and a bit of a craftsman, but also an applied mathematician and proficient at computing.

Pulkovo was a small community of Baltic-German astronomers living an almost monastic life at the Central Observatory of Russia. As several visitors noted,[49] families were constituted there and grew through the arrangement of marriages within the community, and its members lived their lives practically confined to the observatory, which had is own logistics and rituals. During the first decades of Pulkovo´s activity, Wilhelm Struve was revered as an almighty patriarch. His son Otto, who succeeded him as director, maintained the ascendant of the Struve clan over the observatory. The Slavophil sects of the Academy of Sciences of St Petersburg were not pleased with this situation, but the German–Baltic bias and the influence of the Struves would prevail for five decades.

Unfortunately, the available sources do not tell us much about the way Oom lived and moved around the spaces of the Pulkovo Observatory, nor how he interacted with this community. His relationship with Otto seems to have been distant and cold. Although Otto continued his father's work as an advisor to the Lisbon project, he was far from showing Wilhelm's enthusiasm. Neither did Oom seem to have established any especial relations with other foreign apprentices working in Pulkovo. Among them was Giovanni Schiaparelli (1835–1910), later of Mars-canals fame.[50] Oom's warmest personal relations in Pulkovo were seemingly established with the astronomer Theodor Winnecke (1835–1897), who became the first director of the Strasburg Observatory.[51]

In any case, Oom was too busy with his assignments, which also included the study of German language. German was not only the colloquial language in Pulkovo´s daily life, but also the idiom in which some of the most relevant works in the astronomy and geodesy of the day were written. It was mandatory that Oom mastered it as well. He was at the Central Observatory of Russia, but also in a house of German science. As Oom had the chance to learn, Struve and his collaborators were sanguine in this regard. For instance, the repeating circle was much favoured by French astronomers for geodetic operations, but for the Struves, using this instrument was anathema. The theodolite and the reiteration method, emblematic of the culture

[49] See, for instance, Simon Newcomb, *The Reminiscences of an Astronomer* (Teddington: The Echo Library, 2007 [1903]), p. 150.

[50] K. Maria D. Lane, "Geographers of Mars. Cartographic Inscription and Exploration Narrative in Late Victorian Representations of the Red Planet", *Isis* 96, 2005: 477-506.

[51] Andre Heck, "Strasbourg Astronomical Observatory and its Multinational History", in: Andre Heck (ed.), *The Multinational History of Strasbourg Astronomical Observatory* (Dordrecht: Springer, 2005), pp. 1-61.

of precise measurement that developed from the early nineteenth century onwards in the German lands, were always to be preferred. The Struves even went to the point of lambasting the Ertel firm for engaging in the manufacture of repeating circles, as Oom told Folque in one of his dispatches.[52] Wilhelm Struve had also implemented at Pulkovo the principle that a major instrument should have a sole dedicated observer, so that their combined errors remained, as much as possible, constant. This approach, favoured by German astronomers, contrasted starkly with George B. Airy's management of Greenwich, where a number of hired observers performed mechanized observing tasks with the same instrument, according to a well-defined rota, as in a factory.[53]

During the first stage of his apprenticeship, Oom must have spent most of his time between his study and the small observation tower where he worked with the Ertel transit instrument. The opportunity to participate in a Russian expedition bound to Bilbao (Spain) to observe the solar eclipse of 18 July 1860 certainly emerged as an appealing prospect. Oom promptly requested to partake of it. It was not only an opportunity to testify a relatively rare and impressive phenomenon (weather permitting, of course), but also a chance to break temporarily from the routines of his apprenticeship, and to come closer to his native Portugal. But there was work to do all the way to Spain.

3.4 Between the observatory, the workshop and the field: an eclipse tour

In June 1860, on his way to Bilbao, Oom visited the Repsold firm again. The transit circle ordered for Lisbon had already been completed. Oom was instructed from Portugal to analyse it in detail, and then compare it minutely with the Pulkovo instrument upon his return to Russia.[54] This was intended to put him in good stead to install the instrument properly, to take advantage of the improvements it incorporated, and to deal with any technical troubles that might arise when it was put to work. And of course, to make sure that the Repsolds had built the instrument according to the ascertained plans.

Oom also examined an equatorial mount commissioned by the Gotha Observatory, which followed a design suggested by Peter Hansen.[55] Throughout the nineteenth-century,

[52] F. A. Oom to Filipe Folque, 22 January/2 February 1859, Archive of the AOL, FO18.

[53] Simon Schaffer, "Astronomers mark time. Discipline and the Personal Equation", *Science in Context* 2, 1988: 115-145; Robert W. Smith, "A national observatory transformed: Greenwich in the nineteenth-century", *Journal for the History of Astronomy* xxiii, 1991: 5-20.

[54] F. A. Oom to Filipe Folque, 31 July 1860, Archive of the AOL, FO18.

[55] A. & G. Repsold to Filipe Folque, 16 January 1862, Archive of the AOL, C251.

there was a wide effort to turn the equatorial refractor into a proper measuring device, able to compete with meridian instruments in the measurement of celestial coordinates.[56] Equatorials were normally used for micrometric measurements only. A micrometer with fixed and mobile threads would be coupled to the telescope focus, and then used to reckon small angular distances, such as the separation between the two components of a double star, or the distance between a certain star and another star of reference, so that possible changes in position due to annual parallax could be detected. It was chiefly for this last function that Wilhelm Struve had included the equatorial in his plans for Lisbon. Struve also wanted the instrument to be used in the observation of nebulae but he was equally keen to shape it into a measuring device in the sense described above. This required that its mount was very stable, so that the coordinates of the observed objects could be read accurately in the graduated circles attached to the mount's axes. Hansen's design sought precisely to fulfil this requirement. Struve then suggested it be included in the Lisbon equatorial, thus Oom was instructed to study the Gotha prototype and to report on it to Folque.[57]

During his travel to Spain, Oom also visited the observatories of Berlin, Bonn and Greenwich. In Berlin, Oom was welcomed by Johann Encke, who showed him the centralized system of time signals used in that observatory. The system consisted of a master clock electrically connected to slave clocks distributed around in the various observing rooms. Folque considered introducing a similar arrangement in Lisbon; since Pulkovo had nothing similar, Oom returned with a detailed description of the system.

The visit to the Bonn Observatory was also productive. Oom later wrote to Folque[58] about the long conversation he entertained there with Argelander. The astronomer and his visitor thoroughly discussed technical matters such as the design of the transit instrument in the prime vertical, and the best way to set up the piers on which the instruments would rest, in order to avoid the effects of humidity and temperature, and thus provide for higher precision. As already mentioned, Argelander was wary about the viability of performing stellar parallax investigations in the prime vertical, but he reaffirmed his support to the Lisbon undertaking before Oom.

Perhaps because the AOL was already well grounded on the Observatory of Pulkovo and its German networks, the ensuing visit to the Royal Observatory, Greenwich, was

[56] James A. Bennett, *Church, State and Astronomy in Ireland – 200 years of Armagh Observatory* (Belfast: Armagh Observatory/The Institute of Irish Studies-The Queen's University of Belfast, 1990), p. 23.

[57] F. A. Oom to F. Folque, 31 July 1860, Archive of the AOL, FO18.

[58] *Ibidem*.

seemingly more circumstantial. Prior to joining the British and Russian parties aboard the HMS *Himalaya* towards Bilbao, Oom went to Greenwich, where he was received by Airy. He did not report any particular conversation with the Astronomer Royal; nor did he convey any detailed analysis of the instruments, which he said, nonetheless, to have observed carefully, tersely describing them as "monstrous".[59]

This does not mean that Greenwich did not have an influence on the AOL. Folque had visited the British observatory in 1854, in the context of Pedro V´s European tours. This visit was pivotal in motivating him to steer the foundation of a new observatory in Lisbon, as suggested by the enthusiastic recollections he left in his travel journal.[60] A few years after these journeys, a time-ball was installed at the Lisbon port, very likely as an emulation of the Greenwich time-ball.[61] Airy had also advised Folque and other Portuguese dignitaries on matters such as the acquisition of clocks.[62] And the study of electro-chronographic devices at Greenwich was certainly informative.

His eclipse tour had already been worthwhile, but there was still the phenomenon itself to observe. Throughout the remainder of the nineteenth-century, eclipse expeditions would become major social events, causing the paths of science, empire and tourism to converge.[63] For astronomers, professional and amateur alike, they kept on providing occasions to recreate the observatory (at least partially) in the specific circumstances of fieldwork. Similar to what was happening in observatories, laboratories and other sites of knowledge production, fieldwork in astronomy was increasingly subjected to the principle of the division of work, as Oom had the opportunity to experience.[64] He was assigned a very specific task in the context of the Russian expedition: to observe and draw the appearance of the solar corona during the totality of the eclipse, from a station he would set up himself close to a village called Urbaneja, in the outskirts of Bilbao. Although photographic techniques were already applied to the observation of eclipses, the efficacy of photography to capture phenomena such as the solar corona was still a matter of debate. For that reason, drawing remained a valuable procedure.[65]

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[59] *Ibidem*.

[60] Maria Clara Pereira da Costa, *Filipe Folque (1800-1874) – o homem e a obra*, pp. 26-27.

[61] António Estácio dos Reis, *Observatório Real da Marinha*, p. 153.

[62] Correspondence between G. B. Airy and the Count of Lavradio, January-February 1853; Correspondence between G. B. Airy and the Count of Lavradio, Dent and Frodsham, January-March 1855, Cambridge Central Library: RGO 6/145 – Letters from Observatories; George B. Airy to Filipe Folque, 25 August 1858, Filipe Folque to George B. Airy, 13 September 1858, translations (English to Portuguese) in "Acta da Sessão de 15 de Setembro de 1858", Archive of the AOL, FO17.

[63] Alex Soojung-Kim Pang, *Empire and the Sun: Victorian Eclipse expeditions* (Stanford: Stanford University Press, 2002).

[64] The other members of the Russian party were Otto Struve, Theodor Winnecke, and Giovanni Schiaparelli.

[65] Alex Soojung-Kim Pang, *Empire and the Sun*, p. 87.

Oom did very well. Airy, who commanded the British expedition, would later remark that Oom's drawing[66] and those made by two engineers, Bonami and Weedou, constituted the only set of matching representations of the corona obtained from the occasion of this eclipse, whereas the many other depictions analysed by the Astronomer Royal were generally discrepant.[67] This made a good line in Oom's curriculum, but above all the eclipse tour gave him further insights into what it meant to set up an expedition, to extend and recreate the observatory afield, to adapt the apparatus to the conditions of fieldwork, and to organize labour in such circumstances.

3.5 Back to Pulkovo: hard practice and soft espionage

After the preparatory stage with the Ertel instrument, Oom was increasingly given access to other spaces and instruments at Pulkovo, and entrusted with more delicate observations. These included measurements with a circular micrometer; observations of the comets I 1861 and Rümker; observations of occultations; and heliometric observations of the minor planets Troi and Victoria.[68] Oom also partook investigations of the personal equation, that is, of the effect of personal errors in observation, a matter of paramount importance in the nineteenth-century quest for objectivity and precision.[69] Side-by-side with these activities and his ongoing theoretical studies, Oom also studied the Pulkovo instruments in detail, especially those that would also be represented in the apparatus of the AOL. These not only included the transit circle, the prime vertical and the great equatorial, but also accessory devices such as the level trier and the barometer.

Level triers were used to calibrate spirit levels, which served, among other functions, to assess the horizontality and verticality of the axes of meridian instruments. The position of an air bubble as seen against a scale marked on the level's tube could be translated into an angular

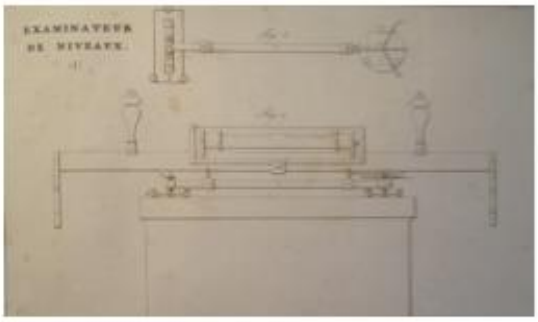
[66] The original watercolour made by F. A. on the basis of his drawing is kept at the Archive of the AOL under the shelf mark F595.

[67] *The Atheneum* no. 1769, p. 376, quoted by José Silvestre Ribeiro, *O Real Observatorio Astronomico de Lisboa. Noticia historica e descriptiva* (Lisboa: Typographia da Academia Real das Sciencias, 1871), p. 21.

[68] Frederico Oom, manuscript notes, Archive of the AOL, A634.

[69] On the investigations partook by Oom see Otto W. Struve, "On the Measures made on Artificial Double Stars, and on the Observations of the Eclipse of 1851", *Monthly Notices of the Royal Astronomical Society* 20, 1860: 341. For a broader contextualisation see: Cristoph Hoffmann, "Constant differences: Friedrich Willhelm Bessel, the concept of the observer in early nineteenth century practical astronomy and the history of personal equation", *British Journal for the History of Science* 40 (2007): 333-365; Jimena Canales, "Exit the frog, enter the human: Physiology and experimental psychology in nineteenth-century astronomy", *British Journal for the History of Science* 34, 2001: 173-197; Lorraine Daston, Peter Galison, "The Image of Objectivity", *Representations* 40, 1992: 81-128; Simon Schaffer, "Astronomers mark time. Discipline and the Personal Equation", *Science in Context* 2, 1988: 115-145.

value, if the level was properly calibrated.[70] Oom used the Pulkovo level trier (Fig. 5) to practise the techniques involved in this operation, and to ascertain a suitable design for a level trier for the AOL (Fig. 6). The device was commissioned to Brauer, the mechanic of Pulkovo.



Figs. 5 and 6 – Schematic drawing of the level-trier of the Observatory of Pulkovo, and photograph of another version of the same device at the Observatory of Lisbon.
(F. G. Wilhelm Struve, *Description de l'observatoire astronomique central de Poulkova,* 1845, and Astronomical Observatory of Lisbon – MUHNAC, Museu Nacional de História Natural e da Ciência)

Brauer was amenable to construct the level trier and to discuss its design with Oom, but displayed a completely different attitude when required to supply a barometer similar to Pulkovo's, which, like the level-trier, he had built himself. In the face of Brauer's reluctances, Folque instructed Oom to make accurate drawings of the barometer and to forward them discreetly to Lisbon. If Brauer was trying to safeguard his barometer model, he did not succeed. Oom made the drawings, the latter reached Lisbon, and the Instituto Industrial de Lisboa (an industrial school in the Portuguese capital) used them to assemble a very similar device. When negotiation did not work, resorting to this kind of soft espionage could be a viable solution.

Towards the end of his five-year stay in Pulkovo, Oom was finally assigned the prime-vertical instrument. Following Otto Struve's instructions, Oom used the instrument to observe the zenith distances of 99 stars, which he would then compare with the same distances as determined with meridian instruments. This was not a stellar parallax programme proper, but constituted important preparatory work for the observations to be made with the prime-vertical of Lisbon.

In August 1863, Oom finally left Pulkovo, endowed with good references from Otto Struve, who already in 1862 had described him as an accomplished observer.[71] Oom was also

[70] Once placed on the trier, the spirit level was subjected to slight changes in inclination, so that the bubble moved along the scale. Readings were made throughout the process in another scale, associated with the level-trier. The angular value of each division could then be determined through calculation. See William Chauvenet, *A Manual of Spherical and Practical Astronomy, Vol. II: Theory and Use of Astronomical Instruments, Methods of Least Squares,* 5th Edition (New York: Dover Publications, 1960[1891]), pp. 75-76.

[71] Excerpts from *Rapport annuel présenté le 14 Juin 1863 au comité de surveillance de l'Observatoire Central Nicolas par le Directeur du dit Observatoire,* transcription in folder A634, Archive of the AOL.

awarded with the 2nd order of St Stanislas, a distinction conferred by the Tsar on foreign men of science, which had previously been awarded to prominent astronomers such as Airy, Leverrier, Bessel, Schumacher and Encke.[72] Some of the works carried out by Oom in Pulkovo were published in the bulletin of the Academy of Sciences of St Petersburg; others appeared in the annals of the Pulkovo Observatory, compiled later by Otto Struve.[73] On his way to Lisbon, he passed again by Bonn, where he attended the foundation meeting of the Astronomische Gesellschaft.

The Portuguese apprentice had become a fully-fledged and respectable astronomer. And he did not return alone to Portugal. Before leaving Russia, Oom married a lady called Alexandrina Müller, whom he had met in his occasional instances of socialization outside the observatory. The anguish expressed in his earlier travelling notes had proved unfounded – at least so far.

4. The AOL in place

4.1 Reshaping the observatory

The construction of the AOL had started in 1861. A few years before, the Struves had sent some architectural drafts to Lisbon. These drafts presented a reduced and truncated version of the Russian observatory, consisting of a building with a central body topped by the dome for the great equatorial, and two observational wings extending to the south and the east (Fig. 7).[74] The Commission was generally amenable to accept all advice that came from Pulkovo, but was not particularly happy with this unimpressive structure. The Struves had simply assumed that functionality should stay above æsthetical value, and that expenses should be kept to a minimum. They certainly knew that the Portuguese authorities could not avail themselves of such liberalities as the "carte blanche" given by Nicolas I. And the instruments would already be expensive enough.

[72] Alan Batten, *Resolute and undertaking characters*, p. 97.

[73] Frederico Augusto Oom, "Vergleichung des Armag-Catalog von Robinson mit der Aboer von Argelander', *Bulletin de l'Academie Impériale des Sciences de St.-Pétersburg* III, 1862: 415-428; 'Observations faites a l'instrument des passages établi dans le premier vertical', in Otto Struve (ed.), *Observations de Pulkova*, vol. III (St.-Pétersburg: Imprimerie de l'Academie Impériale des Sciences, 1870), pp. 227-237; 'Observations', *Ibidem*, pp. 139-199.

[74] FO12, Archive of the AOL.

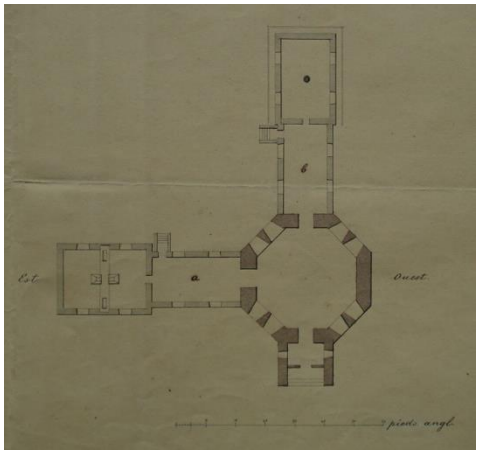


Fig. 7 – Draft of a proposed plan for the building of the Observatory of Lisbon.
(Archive of the Observatory of Lisbon - MUNHAC)

However, the Portuguese authorities understood that if Portugal was to have a sophisticated observatory, then it should be something remarkable, a facility fit not only to observe, but also to be observed, and with reverence. A French architect working in Portugal, Jean Colson, was hired to turn the drafts sent from Pulkovo into the plans of the elegant building, very much akin to Pulkovo's (albeit smaller), which can still be seen and visited today in Tapada da Ajuda (Fig. 8).[75] Many changes were introduced in order to augment its monumental effect: a third wing was added to the west; the observing room of the prime-vertical was moved from the south to the north side, so that an aesthetically unpleasant parasol for daytime observations could be discarded; the entrance, adorned with a neo-classical portico, as in Pulkovo, was relocated to the southern-side, facing the river Tejo.

Fig. 8 – Building of the Observatory of Lisbon.
(Observatory of Lisbon – MUNHAC)

[75] Pedro Abreu, "The Astronomical Observatory of Lisbon: elements for the history of its architecture", in: José Afonso, Nuno Santos, André Moitinho and Rui Agostinho (eds.), *Past meets present in Astronomy and Astrophysics. Proceedings of the 15th Portuguese National Meeting* (World Scientific, 2006), pp. 101-104.

The modest building suggested from Pulkovo was thus transformed into a proper scientific monument. But there was no serfdom in Portugal (at least in the sense it existed in Russia until 1861), and the desire of a humble constitutional king was by no means the same as the caprice of the Emperor of All the Russias. It would take a long time to put up the AOL. To make things worse, Pedro V died prematurely in November 1861. The AOL thus lost its patron when it was little more than a construction site with some foundation works.

This is most likely what Oom found in Tapada when he came back to Lisbon two years later. He had been trained to lead an observatory that was yet to be materialised. He decided then to complete his training as a hydrographic engineer, which, at least, would allow him to progress in his military career. Being the most skilful and learned astronomer in his country, for the time being, was irrelevant for that purpose.

The construction works of the AOL seem to have been resumed in earnest only in 1864. Folque entrusted Oom with supervising the assemblage of its apparatus, namely the construction of the observation rooms, the installation of the instruments, and the completion of the central tower, where the great equatorial was to be set up. Over the next decade or so, hydrographic engineer Oom would act as a sort of astronomical engineer, interacting closely with construction workers, some military officers deployed to protect the observatory's site, and a few scientific collaborators, in order to make sure that all the structures and facilities fulfilled the requirements of precise observation. He would now put in practice much of what he had learnt throughout his journey. The assemblage of the AOL involved procedures such as aligning the observation rooms according to the compass points and disposing its shutters accordingly; firming the piers of the instruments, and assembling the latter; setting up a system of electro-chronographic devices to coordinate time and observation signals all over the observatory's spaces; and designing and assembling the dome of the great equatorial.[76] The delay in the construction of the AOL was possibly advantageous; in Oom's absence, the observatory would, most likely, have been fashioned more as a palace than as a proper observation structure.[77]

[76] Filipe Folque, *Direcção Geral dos Trabalhos Geodésicos, Topographicos, Hydrographicos e Geologicos do Reino - Relatório dos Trabalhos Executados nesta direcção durante o anno de 1871* (Lisboa: Imprensa Nacional, 1872), pp. 8-9; *Direcção Geral dos Trabalhos Geodésicos, Topographicos, Hydrographicos e Geologicos do Reino - Relatório dos Trabalhos Executados nesta direcção durante o anno de 1870* (Lisboa: Imprensa Nacional, 1873), pp. 5-6; Frederico Augusto Oom, "Jornal dos trabalhos executados no ROAL, 1867-1869", Archive of the AOL, FO557.

[77] In fact, during the nineteenth century, several architects involved in the design of observatories sought to remain faithful to the basic structure of Greek temples, usually with results that were not particularly satisfactory. One striking example is the so-called Playfair Building of the Royal Observatory, Edinburgh, at Calton Hill. See Marian Card Donnelly, *A short history of observatories*, pp. 87-94.

In 1867 Oom returned to Hamburg to oversee the dispatch of the instruments he had seen coming into existence, in various stages, during his previous tours. However, as Oom started to unseal the crates back in Lisbon, a Pandora´s box also began to open. The apparatus, in general, looked fine; that was not the problem. The problem was – who was going to work these instruments? Oom could not do it all by himself. Besides, if the AOL was to adopt the principle of one observer–one instrument applied in Pulkovo, thus he would need at least two skilful observers, and ideally three, so that he could concentrate on the observatory's management.

He was certainly pleased to have a recent and promising graduate of the Lisbon Polytechnic School, Henrique de Barros Gomes (1843–1898), coming as a volunteer to partake in the assemblage of the prime-vertical instrument, which was set up between 1867 and 1868. Under Oom´s supervision, Barros Gomes carried out a detailed study of the instrument and the respective observational methods.[78] This was not simply a matter of transmitting what Oom had learnt abroad; it was the full formation of a specialized observer able to work with an enhanced instrument, whose design and construction Oom had followed closely, but that he had never operated himself.

But when Oom was already convinced that he had found a man able to measure stellar parallax in the prime vertical of Lisbon, alas, Barros Gomes left the observatory to embrace a career in politics and administration. And how could the young Gomes, fortunate to be a member of the small highly educated Portuguese elite, be censored? Regardless of his abilities and potential, there was no career for him at the AOL. In fact, there was not even a career as yet for Oom because the AOL did not exist officially as such. During these years, it was a branch of the Portuguese geodetic surveys – a stratagem that Folque, the head of the surveys, had implemented in order to keep the (slowly) emerging observatory under his control.

This situation would change only when the AOL had its own statutory decree. But getting it approved would prove a difficult matter. Oom had thoroughly discussed the organization of the AOL with Otto Struve, Peters and Argelander.[79] There was a consensus among these savants that the AOL should be officially committed to the advancement of stellar astronomy. Priority was thus to be given to the measurement of stellar parallax, the observation of double and multiple stars, and the investigation of nebulae. After all, it was for this purpose

[78] Henrique de Barros Gomes, *A Astronomia moderna e a questão das parallaxes sideraes* (Lisboa: Typographia da Academia Real das Sciencias, 1872).

[79] Frederico Augusto Oom, *Considerações acerca da organização do Real Observatorio Astronómico de Lisboa* (Lisboa: Imprensa Nacional, 1875).

that Wilhelm Struve (who died in 1864) had conceived it in the first place. This programme was to be carried out by a staff of five astronomers, with the assistance of a secretary, two guards, a mechanic, and a carpenter. The principal astronomer, or director, would have the final world in every decision made at the observatory. Each one of the other astronomers would be assigned observations with a specific instrument, and other well-defined tasks. All astronomers were expected to dedicate their lives exclusively to the observatory, eschewing any other jobs or appointments. In other words, the AOL was to be organized according to the principles that governed the Observatory of Pulkovo.

However, these ideas found stark resistance when put forward in Portugal. A statutory proposal originally accorded between Oom and the Academy of Sciences of Lisbon, in which the abovementioned tenets were presented in the form a legal bid,[80] was substantially revised by a parliamentary commission led by António José Teixeira (1830–1900), a professor of mathematics at the University of Coimbra (by then the only University in Portugal). In the new proposal, the AOL appeared as a generalist observatory, not committed to any branch of astronomy in particular. The principle of exclusive dedication to the observatory had disappeared. And the criteria for the admission of astronomers had been alleviated, so that professors from the University and other higher-education institutions were granted access to the scientific posts of the observatory, regardless of their abilities in practical astronomy. Furthermore, the director ceased to be the almighty figure in the administration of the observatory. According to the new proposal, decisions were to be made collectively by a directing board, as in the University. The distribution of power in the observatory was a particularly sensitive issue. As a critic put it in a newspaper article, an almighty director could be acceptable in Tsarist Russia, but it was repugnant in liberal Portugal.[81]

The parliamentary commission had essentially reformulated the bid according to the prevailing culture in Portuguese scholarly institutions. A culture of bookish dons, who often accumulated several political and administrative appointments and sinecures with their teaching duties, and who were supposed to be respected, above-all, for their diplomas and official titles. Practical skill, let alone familiarity with craftsmanship, was irrelevant in this context – if not downgrading at all. The chances of finding skilful astronomers among these ranks were unequivocally low, and even if there were any, they were not likely to deliver themselves to a life

[80] *Diário da Câmara dos Senhores Deputados*, 23 March 1875.

[81] *Diário Popular*, 14 February 1876. The article is unsigned but the author was, most likely, Mariano Cirilo de Carvalho (1836–1905), a politician, journalist and lecturer of Mathematics at the Lisbon Polytechnic School.

of relative isolation at the observatory, with plenty of better career prospects around. Barros Gomes´s case had already provided a clear token.

Nevertheless, Oom fought with all means at his disposal against the new bid. Folque died in 1874. The affair concerning the organization of the AOL lasted between 1875 and 1878. Oom was now fully invested as the harbinger of the "sidereal" AOL. And he succeeded in the end. The programme in stellar astronomy and organizational principles he stood for prevailed in the Statutory Decree of the Royal Astronomical Observatory, which was finally approved in May 1878.[82] However, Oom soon found out that, if the scholarly elite of his country was not a reliable source of prospective astronomers, there was nowhere else to find them.

4.2 Refiguring the apparatus

Oom was lucky, at least, to count on one reliable collaborator, his fellow naval officer and hydrographic engineer César Augusto de Campos Rodrigues (1836–1919) (Figs 9 and 10). When he joined Oom in Tapada da Ajuda in 1869, Campos Rodrigues was already recognised in a local circle of mathematicians and military engineers as a virtuoso with a keen interest in scientific instruments, and an ability to operate, fix and improve them. Campos Rodrigues was also a solitary bachelor, akin to retreat and isolation. He could not have a better place to work in Portugal than the AOL, and Oom could not have found a better sidekick.

Over the years, Oom and Campos Rodrigues would enrich the apparatus of the AOL with several accessories and contrivances.[83] Campos Rodrigues was able to develop what Oom had brought from abroad, in many respects. For instance, he eventually engaged in an investigation of the level-trier constructed by Brauer, which rendered an efficient application of the method of least squares to the calculations involved in the calibration of levels.[84]

[82] *Lei organica do Real Observatorio Astronomico de Lisboa - Carta de Lei de 6 de Maio de 1878* (Lisboa: Imprensa Nacional, 1903).

[83] Pedro M. P. Raposo, "Down-to-Earth solutions for celestial purposes: remarks on the life and works of the astronomer/instrument maker Campos Rodrigues (1836–1919)", in Bart Grob, Hans Hooijmaijers (eds.), *Who Needs Scientific Instruments: Conference on Scientific Instruments and Their Users*, 20-22 October 2005 (Leiden: Museum Boerhaave, 2006), pp. 203-206.

[84] Frederico Oom, *Exames de um nível no Observatório da Tapada* (Lisboa: Imprensa Nacional, 1926).

Figs. 9 and 10 – Frederico Augusto Oom (1830–1890) and Campos Rodrigues (1836–1919).
(Observatory of Lisbon - MUNHAC)

Mechanical and woodworking workshops were eventually installed in one of the two residential buildings that came to complement the main building of the observatory.[85] Observing chairs, photographic apparatus, collimation accessories, slide-rules, reticules, clockwork elements and many other pieces would be built or at least modelled and tested between these workshops, the astronomers' offices, and the observing rooms.

Evidently, the AOL was not self-sufficient. It was vital to keep up international liaisons. Devices such as chronographs were conceived and modelled at the AOL, but ordered from foreign firms, such as Hipp of Nêuchatel (later Peyer & Favarger Co.). The completion of the observatory's premises also required foreign assistance. Oom designed the dome of the great refractor himself, on the basis of the domes he had observed in Pulkovo and other observatories. However, he could not find a factory able to build it in Portugal. The construction of the dome was eventually commissioned from a German firm of naval construction, which sent some of its workers to Portugal for the specific purpose of assembling it in place. The Repsolds intervened as intermediaries, a role they also played in other transactions involving different suppliers of instruments and accessory devices.

It was equally important to interact with local craftsmen. For instance, the mechanics of the Industrial Institute of Lisbon, where, as already mentioned, a barometer similar to Pulkovo's was constructed, on the basis of Oom's "secret" drawings. The Institute supplied the observatory with other accessory devices, such as an electric switchboard through which all electric and chronographic connections within the observatory were centralized and controlled,[86]

[85] Contrary to Pulkovo, where the main building of the observatory also contained the astronomers' lodgings, in Lisbon there were two independent buildings for that purpose, located symmetrically (on the east and west sides) to the main building.

[86] For a description of this device, and others conceived and used in the AOL, see Real Observatório Astronómico de Lisboa,

similarly to what Oom had seen in Berlin, and probably in Greenwich. Another local supplier was Maximiliano Herrmann (1832–1913), a prominent, Lisbon-based electrician, inventor and businessman, with whom the AOL maintained an enduring relation. Thus the AOL constituted a local network of technical expertise through which the functionality and efficiency of the observatory's apparatus could be maintained and even reinforced.

One crucial problem remained: to constitute a stable and competent staff, able to turn the grand stellar project into reality. This, Oom never managed to accomplish. The AOL remained understaffed for most of its first decades of activity. Oom's only full-time collaborators were Campos Rodrigues and another naval officer and hydrographic engineer called Augusto Alves do Rio (1845–1905). But even the latter, albeit a dedicated and competent observer, eventually left the observatory to enjoy the riches of a familial heritage. There was always a better prospect than spending one's life confined to an observatory.

Not for Oom and Campos Rodrigues though. If the grand stellar programme designed by Wilhelm Struve now seemed like a mirage, their shared ability to shape and refigure the observatory apparatus could at least be mobilised towards something useful. Consequently, the grand programme in stellar astronomy was upheld as a foundational badge, but in practice it was left aside in favour of timekeeping. In 1885 the AOL started to transmit the official time via telegraph to a time-ball installed in the port of Lisbon (in replacement of the older time-ball mentioned above). The time signals of the AOL were also disseminated to telegraph and railways stations. The signals were sent from the main clock of the observatory, which was rated according to regular observations of star transits. Everything was done with great care. The AOL's time signals, whose errors were published quarterly in the official journal of the Portuguese Government, became the public emblem of its commitment to precision.[87]

The observations of stellar transits to determine local time were performed not with the transit circle, as originally suggested by Wilhelm Struve, but rather with two small and portable transit instruments, set up in the east wing of the observatory (the transit circle, which in the drafts of the Struves was placed in the east wing, had been moved to the west wing). Each instrument (Fig. 11) consisted essentially of a modified theodolite, coupled to a round base. The instrument could be reversed over the base during the observations, in order to eliminate the collimation error. Oom had conceived this system himself, inspired by a similar functionality in the prime-vertical instrument of Pulkovo. Oom essentially combined this arrangement with

Observations méridiennes de la planète Mars pendant l'opposition de 1892 (Lisboa: Imprensa Nacional, 1895).

[87] Pedro M. P. Raposo, *Time, Weather and Empires: the Campos Rodrigues Observatory in Lourenco* Marques (1905-1930). DOI: 10.1080/00033790.2014.917352

general features of theodolites and some structural aspects of the Ertel transit instrument with which he had begun his apprenticeship.

Fig. 11 – Portable transit instrument designed by Frederico Augusto Oom.
(Observatory of Lisbon - MUNHAC)

Oom negotiated the construction of the rekindled instruments with the Repsolds, who accepted to construct them according to Oom's requirements. The new model ended up included in the Repsold catalogue.[88] Initially just a rapporteur and go-between in these affairs, Oom had also become an instrument designer and negotiator on his own right.

At least in the AOL, the modified theodolites proved efficient and relatively easy to operate. They became the focal point of the AOL's observing activity. Timekeeping, which the statutory decree of the observatory mentioned solely as an ancillary function, was much less enthusing than stellar parallax research. But it was what the AOL was able to perform on a regular basis with the available personnel. And importantly, it gave the observatory a relevant place in the life of the nation. Portugal was under a major effort of infra-structural enhancement, of which the expanding telegraphic and railway networks constituted the foremost representatives. In this context, efficient timekeeping was much more urgent than speculative investigations in stellar astronomy. And one must not forget that the latter were to be fostered as an exploratory programme, with no guarantee of satisfying results. In fact, looking with hindsight, it is not likely that the apparatus and methods proposed by the Struves would bring

[88] For a description of the instruments see César A. de Campos Rodrigues, "Corrections aux Ascensions Droites de quelques étoiles du Berliner Jahrbuch observées à Lisbonne (Tapada)", *Astronomische Nachrichten* 159, 1902: cols. 329-360.

any significant advancement to stellar parallax measurements or to the study of nebulae, which only took off with the application of photography and spectroscopy.[89]

Thus the imposing AOL, an embodiment of a grand research project, was transformed into a rather traditional observatory focused on meridian work. This was, by no means, a rare situation amongst national observatories established before the rise of astrophysics.[90] And the AOL had been, at least, efficiently reworked. But that was seemingly not enough for Oom.

5. Conclusion

The darkest thoughts of the young naval officer and envoy of the Portuguese government apparently still lurked in the mind of the mature astronomer. On 24 July 1890, Frederico Augusto Oom put an end in his life, shooting himself in the head with a revolver. Oom allegedly refused to let himself be consumed by a terminal disease that was diminishing his intellectual abilities. Added to this, he probably never reconciled to the fact that the grand astronomical observatory for which he had left Portugal haunted by insecurity and "saudade", had become little more than a foundational emblem, a virtual image of scientific bravado floating over a rather mundane timekeeping facility.

Oom did not live to see his companion Campos Rodrigues and his son Frederico Thomaz Oom (1864–1930) confirming the name of the Astronomical Observatory of Lisbon as a workhorse of precise astronomical measurement before the eyes of the international scientific community, at the turn of the twentieth century. A land army engineer by training, Frederico Thomaz sought to vindicate his father, becoming an astronomer at the AOL himself, and assuming the role of manager and spokesman of the observatory, as an obsessively low-profile Campos Rodrigues took the official post of director whilst staying in the shadows, immersed in his devices and contraptions.

The renewed Oom–Rodrigues partnership managed to reinforce the staff of the AOL, and to put the transit circle (Fig. 12) to work. In 1904, Campos Rodrigues was awarded the Valz Prize of the Academy of Sciences of Paris for the contribution of the AOL to measure the solar parallax, a parameter of paramount importance in the determination of astronomical

[89] For an overview see John North, *The Fontana History of Astronomy and Cosmology* (London: Fontana Press, 1994), mainly chapters 16 to 20.

[90] Steven J. Dick, *Sky and Ocean Joined – The U.S. Naval Observatory 1830-2000* (Cambridge: University Press, 2003), p. 363.

distances.[91] Even if indirectly, the AOL gave a contribution to the development of stellar astronomy.

The commission of French academics that decided to distinguish Rodrigues noted that the Lisbon observatory had excelled in the measurement of stellar coordinates by meridian observations, working in a situation of material constraint.[92] In fact, the equipment of the AOL had never been substantially renewed, at least in the sense that no major instruments were ever acquired ever since the orders of the late 1850s. The apparatus of the observatory had, nevertheless, been substantially improved. The transit circle that Frederico Thomaz and Campos Rodrigues used to carry out their noteworthy observations was a much-improved version[93] of the instrument dispatched from Hamburg in the late 1860s.

Fig. 12 – Transit circle of the Observatory of Lisbon.
(Observatory of Lisbon - MUNHAC)

[91] The solar parallax is the angle subtended at the sun by the semi-diameter of the Earth. The Astronomical Unit (AU), that is, the average Earth-Sun distance, is derived from the solar parallax. The AU is a fundamental parameter in the measurement of astronomical distances, providing a yardstick to measure all other distances in the solar system. Besides, combining the known angular value of the annual displacement of a certain star – that its, its annual parallax - with the AU, the distance between that star and the Sun can be obtained (note, however, that, even for the closest stars, the values of annual parallax are very small, lying below one second of arc, thus the longstanding difficulty in measuring stellar parallax). On the contribution of the AOL for the accurate measurement of the solar parallax see Pedro M. P. Raposo, "The astronomer/instrument maker Campos Rodrigues and the contribution of the Observatory of Lisbon for the 1900-1901 solar parallax programme", in José Afonso, Nuno Santos, Rui Agostinho, André Moitinho (eds.) *2005: Past meets Present in Astronomy and Astrophysics – Proceedings of the 15th Portuguese National Meeting* (World Scientific Press, 2006), pp. 97-100.

[92] *Comptes Rendus hebdomadaires de l'Academie des Sciences des séances* CXXXIX, 1904: 1075.

[93] For a full description, see note 86.

Over the years, Campos Rodrigues had also carried out studies on personal equation,[94] and developed expedite processes of data reduction involving graphic tools and slide-rules,[95] side-by-side with his many other contrivances. These developments were embedded in the culture of precision in which Frederico Augusto Oom had been indoctrinated. This culture acquired a solid footing at the AOL through his interaction with Campos Rodrigues; Frederico Thomaz Oom would assure its continuity. This was also possible because Campos Rodrigues and Frederico Thomaz Oom were able to incarnate the *persona* of the astronomer as a multivalent and practical expert, which Frederico Augusto Oom had began to embody through his journey. Their common background as military engineers was certainly helpful in this respect.

The accomplishments of the turn to the twentieth century were an exceptionally successful instance of the AOL's effort to make use of an apparatus whose highlights, the great equatorial and prime-vertical instrument, remained practically unused for many years. They were only put to regular use, respectively, in 1910 and 1930 only, but for functions other than those originally indicated by Wilhelm Struve.[96]

At first sight, it is ironic that an observatory modelled on Pulkovo, and equipped with enhanced versions of some of its main instruments, ended up focusing energies and resources on observing spaces and instruments that were, in the case of the transit circle, ancillary, and in the case of the small transit instruments, simply absent from the foundation project. Although Wilhelm Struve had designed the AOL as a condensed and highly specialised version of Pulkovo, the Portuguese observatory was, for many decades, even more redundant than the lavishly equipped Central Observatory of Russia. However, we must not overlook the fact that, by suiting the transit circle and the small transits to precise observation, the astronomers of the AOL gave continuity to a chain of developments in instruments and techniques that were emblematic of the nineteenth-century drive for precision in astronomy and surveying. Given the specific circumstances in which the AOL developed, it was sensible to rely on this well-established chain, instead of engaging in more risky pursuits.

All of these instruments are reasonably preserved and still in place at the AOL. Together with the observatory's buildings, they remain as an embodiment of the grand

[94] Campos Rodrigues, "Personal Equation", *The Observatory* 25, 1902: 121-124.

[95] Frederico Oom, *Méthodes de Calcul Graphique en usage à l'Observatoire Royal de Lisbonne (Tapada)* (Lisboa: Imprensa Nacional, 1905).

[96] The prime-vertical instrument was employed in latitude measurements. The great equatorial was used, in a first stage, for a variety of observations by the astronomer Manuel Soares de Melo e Simas (1870–1934). It was later deployed to the regular observation of occultations of stars by the Moon.

programme of stellar astronomy conceived by Wilhelm Struve, as they also embody the aspirations of modernity and cultural sophistication of mid-nineteenth century Portugal. But above all, they embody the many instances of interaction, exchange and appropriation that took place not only during Frederico Augusto Oom's mission, but also thereafter, in the assemblage of the AOL, in the refiguring of its apparatus, and in the extension and development its networks and circuits.

Far from being a closed embodiment of a somewhat fanciful research project, the AOL functioned as an active and changeable space of technical innovation, grounded on the culture of precision. Not only the AOL assimilated and developed this culture, as it also contributed to disseminate and expand it. It did so in various ways: by providing technical advice and assistance to other institutions, and to other practitioners engaged in surveying works and similar operations; by providing training for hydrographic engineers, some of whom came to play a prominent role in Portuguese science, politics and imperial affairs;[97] and by readapting and exporting its timekeeping expertise to the overseas colonies of the former Portuguese empire.

In 1907 Frederico Thomaz Oom travelled to Hamburg, where his father had stopped several times, in order to examine the timekeeping system of the port of that city. This system was then combined with a reworked version of the AOL's timekeeping apparatus that was installed at the Campos Rodrigues Observatory, inaugurated in Lourenço Marques (nowadays Maputo), Mozambique, one year later. Oom went to Mozambique in person to install the system.[98] His advice was then required for a similar venture in Goa, and fifteen years later he travelled to Luanda, Angola, in order to plan the upgrade of the João Capelo Observatory, located in that city.[99] Thus the circuits of scientific and technical expertise in which the AOL was grounded were extended into the wider geography of the Portuguese overseas empire.

It is unfortunate that Wilhelm Struve's programme for Lisbon remained as a scientific reverie, whilst the dark musings of young Frederico Augusto Oom became a self-fulfilling prophecy. Still, the creative potential of the AOL as a dynamical and open embodiment was stronger than the destructive power of a "sphere of Pb". Oom's journey could thus be continued after his demise.

[97] Pedro M. P. Raposo, "Surveyors of the Promised Land: hydrographical engineers and the techno-scientific resurgence of the Portuguese overseas empire", *HoST – Journal of History of Science and Technology* 7 (2013): 85-119.

[98] See reference in note 87.

[99] Frederico Oom, "Novo Observatório em Luanda', 30 September 1922, Archive of the AOL, DD601.

Acknowledgements

Research presented in this paper was carried out under the grants SFRH/BD/31184/2006 and SFRH/BPD/73373/2010, both awarded by the FCT – Portuguese Foundation for Science and Technology. Earlier versions of this work were presented at Connecting Disciplines - Joint Conference of BSHS, CSHPS and HSS (Oxford, United Kingdom, 4-6 July 2008), and at the 8th STEP meeting (Corfu, Greece, 21-24 June 2012). I would like to thank Prof. Ana Simões, Prof. James A. Bennett, and all the colleagues who presented me with their criticism and suggestions, as well as the anonymous referees. The version submitted to HoST was completed during a stay as a visiting scholar at the Max Planck Institute for the History of Science, Berlin, Germany. I am grateful to Prof. Jürgen Renn and to the MPIWG for providing me with excellent working conditions during my stay.

Ana Cardoso de Matos, Irina Gouzévitch and Marta C. Lourenço, ed., *Expositions Universelles, Musées Techniques et Société Industrielle – World Exhibitions, Technical Museums and Industrial Society*. Lisboa: Edições Colibri, 2011. 222 pp. ISBN: 978-989-689-056-8

by Inês Gomes*

World Exhibitions, Technical Museums and Industrial Society, edited by Ana Cardoso de Matos, Irina Gouzévitch and Marta C. Lourenço, offers a picture of the relationship between world fairs, technical museums and international congresses centered on their interaction and interdependency, a widely discussed topic in the historiography of science and technology. Grown out of a workshop that took place in 2008, the book's relevance and interest relies on the variety of case studies, including episodes from peripheral countries, like Portugal and Spain, seldom dealt in the international literature. Through a dialogue with other contributions to this topic, the chapters emphasize the importance of Universal Exhibitions as places of visits, encounters, exchanges and communication, where information about science and technology circulated and cooperation was developed.

Word Exhibitions, Technical Museums and Industrial Society is organized in three parts: i) Technical Museums and Universal Exhibitions: Bands, Interactions and Temporalities; ii) Universal Exhibitions: Actors and Spaces; and iii) Universal Exhibitions: Sites of Memory, Sites of Leisure. Within this framework, the authors of the eight chapters, written in English and in French, focus on particular events.

As to the first part, in line with current historiographical debates in which the history of collections are gaining importance within the history of science, authors explore the role universal exhibitions played in the development of museums of different sorts—from education to art—and the way in which they contributed to enhance national pride. In fact, the national character of museums in Europe was defined through mutual observation, comparison and appropriations in an international perspective. Although the creation of technical museums was a general phenomenon in this period, it followed different paths, and was led by diverse forces, and offered a variety of organizational structures in European countries. In this process the interest of particular personalities was crucial, as well as their journeys to foreign countries. In the chapters written by Ana Cardoso de Matos, Irina Gouzévitch and Dmitri Gouzévitch, the

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creation of the Museum of Ornamental Arts in Lisbon, for instance, and the establishment of the Royal Cabinet of Machines in Madrid are presented as examples highlighting these dynamics of modernization and construction of industrial societies. The latter also emphasizes the continuity with previous centuries.

As to the second part, Universal Exhibitions: Actors and Spaces, two major topics are dealt with. The first chapter by Miriam R. Levin discusses what the author calls the 'museification' of Paris, i.e., the development and modernization of the city that directly derived from the needs driven by the world exhibitions. The other chapters by Antoni Roca-Rosell, Guillermo Lusa-Monforte, Jesús Sánchez-Miñana and Claudine Fontanon are devoted to the fruitful relationships established between experts during the exhibitions. On the one hand, scientists and engineers played a crucial role in planning and organizing Exhibitions at the same time that Exhibitions provided the opportunity to demonstrate their professional consolidation. On the other, meeting organized in parallel with the exhibitions were important in the exchange and circulation of knowledge and also in the emergence of scientific disciplines.

Finally, the third part of the book addresses the educational role of Exhibitions, as well as their importance in the development of new technology. Taina Syrjämaa and Christiane Demeulenaere-Douyère explore the emergence of industrial societies and its publics, both expert and amateur. 'Edutainment', education coupled with entertainment, was the best way to shape visitors' perception of progress and public good. At the same time, photography appeared as an important means to advertise Exhibitions, as well as national industrial power; for this reason they gained a new scope and depth in this period.

Word Exhibitions, Technical Museums and Industrial Society is an interesting contribution to the historiography of science and technology. Although the topic has been object of various investigations, all the case studies help the reader to make a better assessment of the nature of the complex and intricate symbiosis between museums, exhibitions and meetings, during the nineteenth and early twentieth century, in Europe. Although chapters are short in details, the book contains valuable new material for further exploration. It is excellent in stimulating further research.

Zbigniew Stachniak, *Inventing the PC. The MCM/70 Story*. Montreal: McGill-Queen's University Press, 2011. 214 pp. ISBN 978-0-7735-3852-8

Maria Paula Diogo*

In 2000, Paul Ceruzzi's The History of Modern Computing (MIT Press) established the canonical narrative for the history of computing. All over the world, computer science students as well as the general public interested in this topic read Ceruzzi's book to learn how computers evolved from huge mainframes that occupied a whole building to tiny handy little objects that became our everyday companions. Although Cerruzi clearly stated in the introduction that he had focussed on the United States, just occasionally touching the European and the Japanese cases, his book has been appropriated as a global-wide narrative, very much because California and Silicon Valley are the leading centres of the computer industry.

Zbigniew Stachniak's book deals precisely with one of those other computers that fade into oblivion: the MCM/70 designed by Mers Kuut, in Toronto, Canada, in the early 1970s. Stachniak uses as main sources Kuut's personal archive (which includes a variety of documents ranging from personal notes to management documents) and interviews to the staff that worked in the MCM/70 project, aiming at reconstructing both the human and the corporate sides of the making of the MCM/70.

Along chapters 2 to 4 the author describes how Mers Kuut developed the idea of a microprocessor-based desktop APL computer (APL is a programming language), from the first experience—the Key-Cassette—to the final MCM prototype, how he and his team designed and implemented MCM/70, and how they tackled both software and hardware challenges. In 1973, the MCM/70 was ready to conquer the world: the MCM team successfully toured Europe and, later North America, in both cases MCM/70 being considered as a major breakthrough in the computer industry.

By the time the reader reaches the end of chapter 4 it is impossible not to ask him/herself where it did went wrong. Why don't we have MCM personal computers on our desks? Chapters 5 to 7 answer the reader's growing questions: on the one hand minor technical issues, mainly associated with the power supply, exposed major financial and management problems and eventually led to the fall of MCM; on the other, external factors, such as the North

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American computer hobbyists' movements also contributed to the failure of MCM, as Kuut always kept his interests close to the professional market, disregarding the strong potential of the hobby computer market.

Zbigniew Stachniak ends the book with a nice a conclusion in which he brings together the facts and the testimonies he collected, and reassembles them in a tighter narrative, enabling the reader to revisit the previous chapters and reflect on the way technical expertise interacts with society at large. Despite their low graphic quality, pictures are nonetheless interesting, by showing models of MCM/70 and other computers, as well as advertisements, flyers, and posters. The book also includes a MCM timeline (including the making of MCM/70), bibliography, and an index by subject.

Stachniak's case-study, although sometimes difficult to read, especially by those who do not master a minimum of software and hardware vocabulary, is an interesting reading for historians of technology, in particular for those who are interested in the history of computers, and on topics revolving around centres and peripheries. It is worth mentioning that in this case Toronto, Canada, may be considered as a periphery when compared with the Californian cluster. Also the role played by consumers, in this case the hobbyists' movements, in the success or failure of a new technology, is an interesting topic for computer historians. As to economic and corporate historians, Stachniak's book shows how bad managerial options can jeopardize good technological solutions. The MCM/70 story, which has been "for three decades after its introduction (…) exiled from computing history, remaining no more than a footnote to the personal computer narrative" (p. 188), is thus not an oddity within computer history, but an interesting piece of a larger puzzle, which invites historians of technology to think beyond artefacts and look at the people that shape them, either as experts and entrepreneurs or as users. Zbigniew Stachniak's arguments on the role of the hobbyists' movements, in addition, can be read in the light of the recent book by Ruth Oldenziel and Mikael Hard, Consumers, Tinkers, Rebels, Palgrave Macmillan, 2013, with the greatest benefit. By being a very specific and active subculture, the world of personal computing is particularly appropriate to crisscross these different scripts and look into technology(ies) in an inclusive and broad perspective.

Maria Paula Diogo e Isabel Maria Amaral, *A Outra Face do Império: Ciência, Tecnologia e Medicina. (sécs. XIX-XX)*. Lisboa: Edições Colibri, Colecção CIUHCT, 2012. 198 pp. ISBN: 978-989-689-288-3

By Claúdia Castelo*

The intersection between imperial history and the history of science, technology and medicine (STM) is a well-established research area in the international literature since, at least, the 1990s. However, the role of STM as a structural element of Portuguese colonial history during the nineteenth and twentieth centuries remains largely unacknowledged. The editors of the present volume argue that the importance of the imperial entanglements of STM, allow for new perspectives on the geography of knowledge circulation, and on the study of scientific, technical and medical travels. They also state that such an approach is fundamental to assess contemporary power relations at a national, European and global levels (p. 16).

Based on the results of two groundbreaking research projects, one on national engineering and the African Empire and the other on tropical medicine and the Portuguese colonies, *A Outra Face do Império*, edited by Maria Paula Diogo and Isabel Amaral, addresses these specific issues. To my knowledge, this volume is the first book about science, technology and medicine on the late Portuguese Empire. It collects the contributions of various authors at different stages of their careers and with heterogeneous backgrounds, from Physics to Anthropology. Despite this diversity, the majority has already produced relevant academic work in the field of the history of science and technology.

Organized in ten chapters divided in three parts, each discussing a particular theme — science, technology and medicine — the book covers a wide variety of topics, and makes use of different theoretical and methodological tools, ranging from the well-established academic field of history of science to historical anthropology.

In the first part, dealing with science, the most remarkable contribution focuses on the history of colonial observatories in the Portuguese Empire. Pedro Raposo argues that local conditions, initiatives and networks were central in the making of imperial astronomical science. The second part, about technology, includes an important study, by Maria Paula

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Diogo, on the discourse of Portuguese engineers and their political influence in colonizing Africa; an article by Bruno Navarro focuses on the preservation of colonial heritage and postcolonial identity trough the case-study of Maputo's central railway station; finally Ana Paula Silva presents a critical appraisal of the global links of the Portuguese telegraphic network. In the third part, Isabel Amaral addresses the emergence of tropical medicine in Portugal; Pedro Lau Ribeiro studies the missions carried out by the *Portuguese School of Tropical Medicine* (*Escola de Medicina Tropical*); Cristiana Bastos deals with the distinct models of medicalization, from Goa to Africa, through two opposite architectural styles; finally Rita Lobo focuses on research on malaria and eradication programs in mainland Portugal. The book's introduction pieces together these different case-studies and offers a general overview of the state of the art on these topics.

The volume's main shortcomings cannot be understood without recognizing not only the incipient stage of Portuguese scholarship in this field, but also the different developmental stages of the various investigations, especially in the first part. Maria das Dores Areias' contribution on the role of scientific expeditions to the development of African geological knowledge during the nineteenth century emphasises the minor role paid by the metropolis in such expeditions. This is not a convincing argument, both because the expeditions where organized by the state or scientific groups and because travellers themselves embodied those institutions' specific agendas. In addition, the chapter by João Rui Pita and Ana Leonor Pereira, focusing on the journal *Pharmaceutical News* (*Notícias Farmacêuticas*), has a marked descriptive character in addressing the journal's content regarding African natural resources associated with medical and pharmaceutical uses. Rita Lobo's article, exclusively centred on the anti-malaria programmes in the metropolis, despite its merits, does not contribute to the book's overall coherence.

Regardless of such shortcomings, the book paves the way for new studies on science, technology and medicine in the Portuguese empire. Due to the gap between the elaboration of the chapters and their publication, this volume could not take into account recent important contributions to this dynamic field in Portugal. Nevertheless, it is a fundamental reading for researchers, students and the general public interested in this field of studies.

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JOURNAL OF HISTORY OF SCIENCE AND TECHNOLOGY

Vol. 8 | Fall 2013
ISSN 1646-7752
www.johost.eu