Copernican Cosmography in the First Mexican Physics Treatise

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Abstract

Copernican Cosmography was used to discover the path linking Cebu islands and Acapulco via Kuro-Shivo Stream, as registered in Physica Speculatio, first physics book written in New Spain. Teaching and practice of Copernican theory were an outcome of both Spanish expansion into the Pacific Ocean and native elite instruction devised by Augustinian friars. Copernican cosmography was explained in Physica Speculatio’s first edition in addition to the reference given by Alonso de la Veracruz about the use of Copernican theory to detect Pacific Islands in Physica Speculatio’s Fourth edition. Also, Veracruz’s standpoint about the differences between physics and mathematics is discussed in terms of its relation to the rejection of the Copernican Theory as a Natural Theory.

1 Introduction

In his Physica Speculatio, Alonso a Veracruz considered solar influence as the cause of several natural events in New Spain, namely the abundant and continuous rainfalls at the recently conquered Tenochtitlan as well as the eclipses observed in restricted regions of the World. Veracruz also explains heliocentric theory and the Tychonian system in this production (B. Navarro, 1992:13-24). Also, Alonso mentions in the fourth edition of his Physica Speculatio, the use of the Copernican cosmography in the detection of new islands located at the Pacific Ocean. As stated by Alonso de la Veracruz, friar Andrea Urdaneta used Copernican cosmography to discover the route linking Cebu islands and Acapulco, establishing this way the path followed by the so called Manila Nao (Barrañón, 2004). Therefore, we may say nowadays that heliocentric theory was thought and used in New Spain at the XVIth century.

The article is organized in the following way. The second section deals with the diffusion of Copernican theory in Europe and explains the role played by Copernican cosmography in the integration of the Old and New Worlds, connected by the new commercial route crossing the Atlantic and Pacific Oceans. The third section describes the foundation of

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the Higher Studies at Tiripetío, place where Viceroy Mendoza signed the Treaty that arranged the transpacific expedition led by Villalobos. This very section also deals with the teaching of Astronomy and Exact Sciences at Tacámbaro as part of the Augustinian project devoted to native elite education. The fourth section analyzes differences between physics and mathematics, as stated in the Physica Speculatio, which are similar to those argued years later in order to declare heliocentric theory as erroneous. Finally, the fifth section establishes several conclusions.

2 Copernican cosmography and the Unity of the World

As Veracroce explains in his Physica Speculatio, there is only one world, embodying the newly discovered Spanish territories (Alonso de la Veracruz, 1573:223). Veracroce describes several Spanish settlements in America, including their geographic location and makes mention of the mastership of the Augustinian friars who were selected as ship pilots for the detection of the Pacific Ocean Islands. As explained by Veracroce in the fourth edition of his Physica Speculatio, the Spanish king had chosen Urdaneta to be ship pilot in the exploration of the Pacific Ocean. In order to comply with this royal command, Urdaneta used Alphonsine and Copernican Tables to delineate the path linking Cebu Islands and Acapulco. As long as these islands belonged to Portugal, as signed in Tordesillas Treaty, their cosmographic location as well as the discovery of this new route were considered of utmost strategic importance for the Spanish crown (Alonso de la Veracruz, 1573:223).

It is easy to understand that Copernican Cosmography was taught in New Spain in the XVIth century as long as Copernicus distributed a short version of his master work, De revolutionibus, ever since the beginnings of that century. This Commentariolus, arrived to Cracow by 1514, as a theory book affirming that the Sun is at rest while the Earth moves around the Sun (Noel Swerdlow, 1973: 423-512). Besides, it is well known that Alphonsine Tables were part of the Copernican personal library that included also the Tabulae directionem and the In iudiciis astrorum by ar-Rijal (Swerdlow y Neugebauer: 3-11). Therefore, when Veracroce wrote his Physica Speculatio, the Copernican theory was well known in Europe and perhaps Veracroce knew about it while he was studying and teaching at Salamanca University or in his epistolar exchange with Urdaneta.

The detection of the Manila Nao tornaviaje (return route) demanded the acquaintance with the weather and geographical profile of the Pacific Ocean, in order to apply the same formula used by the Spaniards to find the return route in the Atlantic Ocean, following a northern route. This was the contribution of the Augustinian monk Andrea Urdaneta, who benefited from the experience gained from previous California explorations and succeeded in discovering the tornaviaje of the Spanish route to the Philippines. Friar Andrea Urdaneta kept a copy of the De revolutionibus and held epistolar exchange with Alonso de la Veracruz. Urdaneta received Augustinian orders in 1553 once he declined the invitation to be general of the Navy destined to discover the Western Islands. By 1564 Urdaneta was ship pilot of Legaspi expedition to Cebu Islands, departing from Barra de Navidad. When Urdaneta came back from Cebu, he found the return route to New Spain, reaching Acapulco in 1565. During this travesy, Urdaneta profited from Kuro-Shivo Stream,
heading northeast until he reached latitude 39 N though later Urdaneta turned to latitude 32 N, just to make sure that latitude was under control. This way Urdaneta succeeded, after five failures by others, in the detection of the return route that provided vast richesses to Spain ever since the new found lands were extremely rich in gold, wax and other luxurious merchandises (Lothar Knauth, 1972).

As long as the king of Spain had signed Tordesillas Treaty leaving Philippines in hands of the Portuguese, he tried to control these islands taking advantage of the fact that Philippines were not inhabited by Portuguese at that time. With this purpose, in 1542 the Spanish crown organized a military expedition to these islands, baptising them as Philippines Islands. Urdaneta had lived nine years in Moluccas Islands, that were recovered from the Portuguese in 1535, as demanded by the Spaniards inhabiting them since Portuguese crown had paid 35000 ducados for these islands in 1529 as part of the Zaragoza Treaty.

Notwithstanding in 1536 Portuguese stripped Urdaneta of his records and maps relative to the journeys of Loaysa and Saavedra, friar Andrea was able to provide an oral version of his travel through the Pacific Ocean while he stayed at Valladolid in 1537. After that unfortunate event, conquistador Pedro de Alvarado asked Urdaneta to help him in some expeditions to New Spain’s Pacific coast that Alvarado had in mind. With this purpose, Urdaneta embarked in a ship to New Spain in 1538, though Alvarado’s death delayed his participation in this kind of navigations until he joined Pensacola exploration in 1539. The main motivation for the Spanish king to arrange Legaspi’s expedition, selecting Urdaneta as ship pilot due to his mastering of the Pacific Ocean navigation, was the enforcement of Spaniard dominion over the Philippines. This proved to be a convenient strategy when in the XVIth century Portugal forced Spain to accept the border lines in Uruguay, arguing that in order to comply with Tordesillas Treaty, Philippines and Moluccas should be restored to the Portuguese crown.

Once the return route linking Cebu and Acapulco was discovered by Urdaneta, an intense galleon traffic was established between Philippines and New Spain. Manila Nao sailed from Acapulco at a date between the end of Autumn and the beggining of Spring. Galleons headed to Cebu once they left Guam, though later they did it to Manila Bay. This was a strategic consequence of the use of the Copernican cosmography in the delineation of this new commercial route that transformed the Spanish king into a Universal Monarch.

As long as Philippine Nao transported works of art used for sumptuary Arts, Mexico city inhabitants celebrated the arrival of the Manila Nao ringing the cathedral bells. Galleons transported oriental merchandises such as porcelain, regarded at that time as white gold, in volumes simmilar to those carried by dutch cargos, which turned New Spain into a commercial emporium (Curiel, 1992).

The benefits of this Manila Nao’s return route impeled the exploration of the Alta California by 1570, searching for a safe harbor for the Chinese Nao. Viceroy archbishop Moya y Contreras arranged the search for the Armenian islands, probably the Hawaiian Archipelago, with the intention to use them as a intermidiate port for the Philippine Fleet.
3 Augustinian teaching of cosmography in Michoacán

Fray Alonso de la Veracruz instituted the Colegio Mayor at Tírapetío in 1540, when missions departed from Tírapetío and Tacámbaro expanding Augustinian territories into the Tierra Caliente at the state of Michoacán. At the Colegio of Tírapetío, students were so well trained that material culture improved in such a way that it was possible to build new convents and cities in the surrounding areas though their demand deserted the Colegio Mayor. Philosophy and theology were taught for the first time in America at Tírapetío, place where Viceroy Mendoza signed a Treaty to explore the Pacific Ocean. Besides, in Tacámbaro, Alonso de la Veracruz created an astronomical observatory and taught therein astronomy and exact sciences (Mauricio Beuchot, 16-17). Grijalva wrote that the library brought to existence by Veracruz included of maps, celestial and terrestrial globes, astrolabes, horologes, *ballestillas* used to measure angles, planispheres and every instrument employed by Liberal Arts.

This library was formed with the huge collection brought by Alonso from Spain in 1573 (Juan de Grijalva, fols. 153v y 154r). In this Atlantic journey, Alonso was accompanied by nineteen friars to New Spain, as part of his appointment as Visitador of the Augustinian Congregation in New Spain, Peru and Philippines. In this position he was consulted by friar Domingo de Salazar, bishop of Manila, to solve the controversies between clerics and regulars (E.J. Burrus, 1968-1976:63-103).

By all these contributions to the organization of the scientific studies, Veracruz was considered ecclesiastic master in New Spain (Sergio Méndez, 1952:36). As stated by Sergio Méndez Arceo, Augustinian Congregation was leader in the establishment of Major Studies in New Spain, excelling other ecclesiastical orders that arrived earlier, namely dominicans and franciscans. Colegio of Tírapetío received donations from Spaniards and natives, founding five haciendas which linked to other plantations formed a passageway connecting the Augustinian province. As reported elsewhere, Valladolid’s Augustinian convent operated as a bank whose influence extended over Zacatula, Zinapécuaro, Guanajuato, Tírapetío, Jacona and Ixtlán (AHMC, Negocios Diversos, leg. 1 1555-1159).

Don Antonio Huitziméngari, son of Michoacán’s king, studied and taught at the Colegio Mayor de Tírapetío, as part of the Augustinian project devoted to the education of native elite. Huitziméngari, who was formerly educated at the franciscan convent of Tzintzuntzan, came to Tírapetío in 1540 when Veracruz was principal of the Colegio Mayor, where Huitziméngari studied sciences, philosophy, theology and languages.

In 1543, Colegio Mayor moved to Tacámbaro while the students missioned into the Tierra Caliente twice or thrice a year. And in 1540, Vasco de Quiroga founded the Colegio de San Nicolás, to educate clerics proficient in native languages. When Alonso de la Veracruz governed once again this province, from 1548 up to 1551, the considerable amount of graduates from the Higher Studies helped to institute convents at Guayangareo, Cuitzeo, Yurihipúmbaro, Huango and Charo. Therefore, the Augustinian Congregation had already organized the study of cosmography in New Spain when Jesuits first arrived to New Spain and were commissioned to administer the Colegio de San Nicolás in 1574. The arrival of four Jesuits in New Spain had been frustrated by illness in 1553 (Juan Moreno, 1965:80). Jesuits received a donation in 1576-77, given by the Ayuntamiento of Guayangareo-Valladolid, establishing therein a Colegio.
This Colegio instructed Grammar to only four locals in 1580-1581 and was supported by the generosity of the franciscan an augustinian congregations.

4 Heliocentrism as a Natural Theory

Heliocentrism adheres to Aristotleian cosmology inasmuch as Copernicus assumes a natural motion of Earth and planets, considers that Sun remains still, includes celestial spheres and regards a stationary higher sphere at the universe’s border. Copernicus is unique in terms of his ability to reach an agreement among Neoplatonics, Pythagoreans and Cabbalists.

In spite of the reputation earned for his mathematical resources, when Copernicus places the Sun in the center of the planetary motions where the Sun should be best placed to enlighten the planets, Copernicus recollects Hermes Trimegistus who called the Sun a visible God (N. Copérnico, 1873: 15-17). In regards to solar influence, Veracroce follows a natural perspective to deal with the eclipses and local time delays between America and Europe. For example, Alonso a Veracroce uses the circular shape of the Earth to explain what we call today time zones as well as the fact that eclipses are only visible in some regions of the planet. Veracruz uses this geometrical scheme to explain local time delays between Mexico City and Toledo (Alonso de la Veracruz, 1573:223).

Alonso recognizes the failure of Aristotle’s Meteorology Treatise, whose Second Book predicts that excessive sunlight should avoid the presence of water, snow and abundant vegetation in the torrid zone. Instead of, Alonso reports copious and continuous rainfalls as well as snow production nearby Mexico City (Alonso de la Veracruz, 1573:281).

In agreement with this natural perspective, Alonso denies any astrological influence on terrestrial events, but accepts solar lightening as a natural cause, rejecting all grounds to the Treatise Disputationes adversus astrologiam divinatricem written by Pico de la Mirándola (Alonso de la Veracruz, 1573:281).

Alonso explains heliocentric theory in Chapter XVII of the Treatise on Sphere written by Campano, telling that some people consider that Earth is always orbiting and fixed Stars stand still (Bernabé Navarro, 1992:13-24), namely a theoretical postulate of the Commentariolus (Alfred Romer,1999: 157-183). Veracroce’s explanation of heliocentrism is supplemented by his expounding of the Tychonian system in Physica Speculatio’s Chapter 52 (Bernabé Navarro, 1992:13-24).

Copernicus used mathematical arguments to ground a System of the World, in spite of the hierarchy of disciplines accepted at that time, where physics occupied a higher place than mathematics. That’s why Giovanni Maria Tolossani criticized De Revolutionibus, since Tolossani disregarded Copernicus as expert in physics and Holy Scripture (E. Garin, 1976:288).

In a simmilar fashion, Cardinal Bellarmino considered physical hypothesis as mere computational premises, establishing an important an-tecedent to the rejection of heliocentrism as a theory of Nature (A. Koestler, 1986:1 125). These were the premises assumed to classify heliocentrism as erroneous in 1616, besides the authenticity declaration of the Vulgata Latina at the Tridentine Council.

Alonso Gutiérrez considers substantial differences between physics and mathematics, as stated in his Physica Speculatio. They are different in regards to the object of study as well as to the level of abstraction. This
way, Veracroce adheres to the standpoint held by Roman College, that sustained the incapability of mathematics to provide a thorough image of the World.

5 Conclusions.

As declared by Alonso de la Veracruz, Copernican cosmography was used to discover the path linking Cebu islands and Acapulco via the Kuro-Shivo Stream. Also, Copernican cosmography was explained in the *Physica Speculatio*, first physics book written in New Spain. Teaching and practice of Copernican theory were a byproduct of the overseas Spanish expansion as well as of the native elite instruction devised by the Augustinian friars. Notwithstanding *Physica Speculatio* is devoted to Aristotelian and Ptolemeian cosmography, Copernican theory is already explained in *Physica Speculatio* first edition and the practical use of Copernican theory to detect the *tornaviaje* is mentioned in its Fourth edition. Nevertheless, Veracroce accepts that physics and mathematics employ different abstraction levels and are dedicated to distinct objects of study. This way, Veracroce implicitly supports the standpoint of the Roman College, that finally declared Copernican theory as erroneous inasmuch as a mathematics was considered unable at that time to provide a natural theory.

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