BETWEEN FAITH AND THE HEAVENS: INSTRUMENTAL EXCHANGE AND SCIENTIFIC DIALOGUE IN CATHOLIC–SAFAVID ENCOUNTERS

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Abstract: The study examines how the collision of ideas and traditions in astronomy between Catholic missionaries and Safavid scholars shaped intercultural relations and strengthened mutual exchanges. Early modern period travel and missionary accounts indicate that astronomy held a prominent place within Safavid education and scholarly culture, shaping both intellectual exchange and diplomatic encounters. This study highlights how Catholic missionaries employed scientific knowledge as a form of soft diplomacy. They introduced innovations and played a key role in circulating scientific instruments that served as tools of knowledge exchange and cultural negotiation. Focusing on missionary correspondence and visual artefacts, this article argues that the contributions of Catholic missionaries to the scientific development of the Safavid Empire have been overlooked, as they not only participated in exchanges but also introduced changes in the characteristics of instruments. By bringing undervalued materials to light and revealing cross-cultural Catholic-Safavid exchanges, the article aims to offer new perspectives on the history of science and visual culture.

Keywords: Safavid Empire, Catholic missionaries, cross-cultural exchange, knowledge circulation, early modern science

INTRODUCTION

In the early modern world, Catholic missionaries—particularly Jesuits, Dominicans, Carmelites, Capuchins, and Augustinians—journeyed along the Silk Roads through Persia, combining their experience with indigenous intellectual knowledge. Travellers and

missionaries who visited the country knew that astronomy was a highly respected field of science among the Safavids and an essential part of their education, reflected in the gifts brought and the celestial dialogues they engaged in. According to Susan Mokhberi, mutual exchanges in mathematics, astronomy, and theology softened the unfavourable view of travellers such as Pietro della Valle about the Safavid Empire (Mokhberi 2019, 78). It is important to note that, according to the chronicle of the Carmelites, after the Ottoman recapture of Baghdad in 1638, the Bishop of Baghdad, Fr. Bernard of St. Teresa, who was also vicar apostolic of the diocese of Isfahan, resided in Isfahan (Chick 1939, 208). During the reception by Shah Safi I, he made an impression on Shah when his knowledge of astronomy was ascertained, and the Safavid Shah offered to teach this science to those interested. This encounter shows how Carmelite missionaries strategically used celestial knowledge as a tool of soft diplomacy, building intellectual trust among political and scholarly circles. I would like to highlight that the arrival of European travellers, missionaries, and embassies at the Safavid court gave rise to new ideas in the development of celestial maps, sundials, globes, and astrolabes. In Sonja Brentjes' opinion, there is another curious reason for introducing innovations to the East: the new instruments were one of the methods to tempt Orthodox youth to the Catholic faith. Also, the invention of sighting tubes in various sizes tempted travellers to use them as spy instruments in Oriental houses, so as to take a glance at scandalous events (Tommasino, P. M. 2012).

The Safavid officials invited Catholic missionaries to their palaces to debate with Shiite scholars on scientific and religious issues. For instance, the Safavid Grand Vizier (Prime Minister) Mohammad Beg, known as the "ruler of the Azerbaijan", had a palace in Isfahan staffed by Jesuit missionaries, and debates between missionaries and mullahs were common. This article investigates how Catholic missionaries contributed to the development of science and how the collaboration and exchange between Safavid scholars and European scientific figures influenced the artistic and

technical characteristics of instrument designs in both cultures. Furthermore, what roles did scientific instruments—such as astrolabes, sundials, globes, and clocks—play in the intercultural dialogue between two distant places, such as European countries and the Safavid Empire?

The State of Science and Education in the Safavid World

Catholic-Safavid encounters reveal how Catholic missionaries strategically used celestial knowledge as a tool of soft diplomacy. This approach helped build intellectual trust among political and scholarly circles. According to the chronicle of the Carmelites, after the Ottoman recapture of Baghdad in 1638, the Bishop of Baghdad, Fr. Bernard of St. Teresa, who was also vicar apostolic of the diocese of Isfahan, resided in Isfahan. During the reception by Shah Safi I, he made a strong impression on the Shah when his knowledge of astronomy was recognised. The Safavid Shah even offered to teach this science to those interested. Capuchin friar Raphael du Mans described science, particularly astronomy, as highly prominent and widely taught in the Safavid world. In some ways, he observed that it was more visible than in early modern France. He wrote, "Their way of teaching and taking lessons is to choose someone they want as regent because here to teach is the supreme degree of honour. The teachers do not want to deprive themselves of it. They learn the language, science, and knowledge in detail to earn the title of doctor. In France, this word 'to teach', which cannot wash away the last insult of the world, which is pedantic, is much envied for fame but not for profit (Mans 1890, 166-169)". He also remarks in his "L'Estat de la Perse en 1660" ("In the State of Persia in 1660") that "They have here the 'Almagest' of Ptolemy in Arabic, the 'Sphaerica' of Menelaus and Theodosius, several sorts of theories like medium movements of planets of Mirza Ulugh beg, Euclid in all his works, some fragments of Archimedes and Apollonius, also the work of Ebn Heissen, books of arithmetic, elm-e-hasabe, and algebra of

optics". We can see the Safavid court's interest in astronomy from Raphael du Mans' notes. He pointed out that The king spends more than twenty thousand tomans each year to maintain his astrologers, *monagem*, who are always near him with their astrolabe to take the right hour, the ascendant, to dominate, and to say when it is good to sit, get up, leave, eat, go to bed, dress such and such a colour, so it means that he is in their absolute disposal. Even they will let him enter by the Saint Honoré or Saint Martin door, making him wait on foot until the moment of the necessary constellation has arrived (Mans 1890, 164).

On the other hand, Raphael du Mans lists drawbacks, including not using chairs, teaching different subjects at the same time, and the dependence of teachers on students, compared with France. A schoolboy will not content himself with a lesson in some sort of science in a day, he will take a lesson in logic, physics, theology, and grammar, as well as the teachers, who would think themselves dishonoured if they had refused to teach any science that is asked of them. I want to draw attention to the fact that he dedicated this work to the French minister Jean Baptiste Colbert. Jean-Baptiste Colbert was the principal figure in establishing relations with the Safavid empire and the principal financier of the missionaries. They were instructed to bring manuscripts from the countries they visited and study them. These manuscripts were translated and given to the royal library.

It should be noted that, as a result of Jean Baptiste Colbert's financing, a number of works were translated into French. In the 1650s and 1660s, the Safavid travelogues of Adam Olearius, Adam Wickfort, and Silva Figueroa were translated. Since Raphael du Mans was a translator at the palace, he was aware of the negotiations there and sent information on the Safavid empire's diplomatic relations with France. In contrast to Raphael du Mans, Jean Chardin criticised French authority for controlling science through scientific institutions such as the Royal Academy of Science, founded in 1666 by Louis XIV at the suggestion of Jean Baptiste Colbert. Scientists were made subjects of the government to increase the state's

income. Jean Chardin regarded Safavid science as a standard of excellence and claimed that no country in Europe esteemed science more than the Safavid Empire (Chardin 1717, 107). He shows that even science a part of life of peasants or poor people: "A lot of peasants read good books themselves and bring up their children in the sciences, as much as the convenience of their condition permits, and for that purpose, they send the children at the age of five and attempt to bring them into the public colleges, where not only are the tutors engaged to teach, but the pupils are still to learn, in order not to be impede by poverty" (Chardin 1717, 108).

Furthermore, the scale and significance of education in the Safavid world are evident from contemporary observations; Engelbert Kaempfer, for example, a Swiss ambassador, reports more than 100 colleges or schools in the royal city of Isfahan alone, which surpass European schools in luxury and architecture (Kaempfer 2018, 98). He also compares the salaries and living conditions of students: "The salary of the rector is very high. The royal schools pay 100 tumans; in the other schools, it is more or less 50 tumans in most cases. It would be wished that our professors in Germany achieved such good luck. As our students are in dormitories, they live in the colleges like lodgers. Their eating is not eating together. They receive 1 abbasi in the royal college, the others are given 1 mahmudi or shahi" (Kaempfer 2018, 99). Fr. N. Sanson further complements this picture by describing the subjects taught within these schools: "There are Public Schools in Persia where the Alcoran is explained by the Doctors; they also teach Astronomy, Philosophy, Law, and physics. Aristotle is their way for Philosophy and Avicen for Physics. The Study of the Laws is very much esteemed among them; for Magistrates apply their children strictly to it, and they also take great care to instruct them in it themselves, by asking every day their opinion in some case they have adjudged" (Sanson 1695, 154). Taken together, these accounts point to a vibrant educational landscape in the Safavid world, characterised by both institutional scale and curricular diversity. This environment provided fertile ground for missionary engagement, where scientific

knowledge—particularly astronomy—could serve as a medium of intellectual exchange and a tool for fostering trust across cultural and religious boundaries.

Catholic missionaries played a key role in introducing innovative devices and tools to the Safavid world, thereby expanding both local scientific practices and intercultural knowledge networks. The French traveller Tavernier, in his "*Voyages in Perse"*, stated that several royal officials in Isfahan had instruments made by the Capuchin Raphael du Mans (Tavernier 1676, 579). Various sources state that a Capuchin friar, Raphael du Mans, invented the telescope, compass, sundial, and globe, and developed a cartographic grid. J. Chardin writes about it: "The superior of the Capuchins of Isfahan, with whom I first lodged, a strong man versed in mathematics, had given me his knowledge. He often led me (to the most famous astrologers for the manufacture of astrolabes) and taught me to hear about what I see done" (Chardin 1711, p.109). David King approached the grid, making fact with suspicion. He emphasises that we should remember that he was in Isfahan for not helping Muslim people to solve scientific problems; his duty was to convert Muslims to Christianity. D. King stresses this point with the thought that Raphael du Mans had a negative attitude towards Islam, and he could not devise a grid solving the qibla problem. If Raphael du Mans had made such a map, it could have been mentioned in his writings.

Among Raphael du Mans's contributions to science, the Galilean telescope is particularly noteworthy. A Safavid author from the 17th century, ʿAbdallah Isfahani Efendi, in his *"Riyaẕ al-ʿulama"* (1694), refers to Mulla Muhammad Salih Qazwini's *"Nawādir al-ʿulūm wa-l-adab"*, which mentions that Raphael du Mans devised a telescope resembling a bamboo pipe (Arjomand 1997, 14). He reports that it was 2.08 meters long and many stars were revealed, including the Pleiades (Seven sisters). Even the Safavid viewers were able to see "cities, jungles and lands" on the uneven surface of the Moon (Huff 2010, 132-133). While Catholic missionaries introduced a range of instruments and devices to the Safavid world,

some did not impress the court because they were already common tools in their scientific practices. Tavernier, in his *"Voyages en Perse"*, mentions that this Capuchin friar devised "a very beautiful compass in the form of an astrolabe" and gave it to Shah Abbas II, along with requesting a favour. However, this present did not attract the Safavid shah. After asking about the instrument's function, he sent a friar to the chief astronomer to inform him as well. We can attribute the Shah's lack of interest to the fact that, in the mentioned period, the use of a compass became common. In his description of mosques, Tavernier writes about the pocket compasses used by local people to find the qibla. David King is also of the same opinion that if it were an astrolabe, it may arouse curiosity in the Royal Palace. But Raphael du Mans himself notes that their astrolabes are better than ours in France: they have plates of divided and subdivided forms to quickly draw the circles of the astrolabes. A remark by Capuchin friar M. Febvre in his *"Teatro della Turcia"*, published in 1684, shows that Raphael du Mans devised a globe for the Safavid shah Soleyman: "I had taught him a little astrology, and he showed a very curious little globe one day to the other courtiers as a rare and particular thing in the king's hall. That gentleman told with a smile that it was a work by Raphael, destined for his majesty. After this, I ask him for an explanation of the globe and all its parts. Upon which I have given full satisfaction. The Safavid shah was not pleased with the globe because the Safavid Empire could barely be seen on it" (Febvre 1684, 209).

Scientific Instruments as Mediators of Catholic–Safavid Exchange

The arrival of European travellers, missionaries, and embassies at the Safavid court spurred the development of celestial maps and astrolabes. The inscription on the astrolabe, made by Mohammad Mahdi al-Khādem in 1654–55, attests that the Safavid astronomers became acquainted with European innovations. According to Sonja

Brentjes, J. Tavernier presented a celestial map of the Safavid astronomers, which seems to have served as orientation for the engraving of star maps of the northern and southern hemispheres on his astrolabe (Brentjes 2021, 444). The inscription in the cartouche of the northern hemisphere states: "Since there were inconsistencies in the locations of the fixed stars among earlier scholars, and the most appropriate [star maps] were in the observatories of the Franks [of Western Europe], the locations of the fixed stars are shown here based on authoritative observations over the past ten years". David King (1999), Sonja Brentjes (2021), and Emilie Saavage-Smith (1997) claim that Jean Baptiste Tavernier transported his brother Melchior Tavernier's map to the Safavid court, a copy of which is currently preserved at the Bibliothèque Nationale de France. Muhammad Mehdi devised two other astrolabes with the same inscription: "This is the mirror of Alexander, and this mirror represents the whole universe". Both astrolabes were made in 1659-1660 and are included in the collections of the Greenwich Museum and the Whipple Museum of History and Science accordingly. During the examination of the astrolabe kept in Greenwich, it was revealed that Muhammad Mehdi engraved Melchior Tavernier's map in one of the five plates of the astrolabe. He described only the Northern Hemisphere in the Greenwich version. The top of the astrolabe is a triangular shape, and both sides are delicately pierced with dedicated inscriptions to Safi Goli Beg, an Emir at the court of Shah Abbas II. He also gave the names of 78 places on the engravings of the astrolabe along with the inscription relating to "14 protected holy ones" (the Prophet Muhammad, his daughter Fatima, and 12 imams). The signature of Muhammad Mehdi is on the back of the astrolabe: "Ibn Muhammad Amin Muhammad Mahdi al-Hadim al-Yazdi is poor in the sight of Allah Almighty, may Allah forgive her".

It is interesting that a recent study in the map collection of Bodel Nijenhuis of the Leiden University Library uncovered a celestial map of hemispheres. The celestial hemispheres, published in a book dating to the early 17th century, have illustrations on both

hemispheres that closely match those of the celestial globe made by Amsterdam cartographer-publisher Willem Jansz Blaeu. However, the mapmaker did not copy Blaeu's globe in every detail and changed some illustrations. But during the examination of Melchior Tavernier's celestial map, we noticed that there are no changes in details, and he described all the details in the Dutch author's map. Here, the question arises: which copy of this map was Muhammad Mehdi familiar with? Was he inspired by Melchior Tavernier, as Sonja Brentjes, David King, and Emile Savage-Smith claim? It is known that during the mentioned period, all Europeans who came to the Safavids were referred to as francs (firəng), regardless of their nationality. In addition, the Catholic missionaries served as intermediaries in bringing various European clocks or clockmakers to the Safavid lands. The great interest of Safavid Shahs in European technology can be seen in Fr. Sanson's records: "He (Shah Suleiman I) receives all kinds of labourers from Europe into his Service; He respects and welcomes workers from Europe. But he most respects the French, among whom there are now many skilful and excellent clockmakers and Jewellers. He pays them a very large salary, and some of them receive 2,500 livres yearly, which, with all necessary provisions, amounts to a large sum. The king values their work so much that he will not employ them for anyone else. He also hosts some Chinese and a large number of other Artists from all the nations of Asia" (Sanson 1695, 52).

One of the facts showing that French artisans served the Safavid Shah at the Safavid court is the record of the French traveller Daulier Deslandes, who visited the Safavid lands in 1664 -1665 together with J. Tavernier. Daulier Deslandes, in his travel account *"Les Beautez de la Perse ou la description de ce qu'il y a des plus curieux dans ce royaume"* (The Beauties of Persia or the description of what is most curious in this kingdom), notes: "There live seven francs serving the king, two watchmakers, a goldsmith, and three arquebuses who are married. Here is also Monsieur l'Estual, a great statesman, who is very comfortably settled and lives like a prince; he did not serve the king. Of these seven Franks, only two were

Catholic. They all have strong recommendations from the king" (Kroell 1979, 13).

It is further known that the European kingdoms, including the Papacy, sent various gifts to the Safavid shahs. In the examination of Carmelite notes, we can see that Pope Innocent XII dispatched his nephew as an ambassador to Shah Sultan Husain (1694-1722) with gifts. However, the Papacy did not provide the embassy with sufficient financial support, which resulted in a reduced effectiveness of this mission. The papal presents remained in Aleppo due to a lack of cargo expenses. But the ambassador himself presented some gifts, including clocks, to the Safavid king: "As to the presents which I brought to the Shah, I was asked whether I was presenting them "on behalf of the Pope, and of the other kings, or in my name. I answered that "the gifts which were sent by the Papacy had remained in Aleppo. If Majesty so desired these gifts, he might be so kind as to bring them, but these presents I was offering in my name. I presented the Shah with two fine gold brocade from Venice, esteemed at 250 'ungari': an alarmed large clock striking the hours, esteemed at 140 'ungari': "another smaller one, also striking the hours, with a gilded case and enamelled, esteemed at 210 'ungari': one gold filigree box with engraved images, valued 150 'ungari': a clock, with a gold-plated case covered with diamonds bestowed me by the Princess of Valdimono, of the cost of 100 'ungari': a device to raise weights, which I had made a new and "which was well approved, evaluated at 50 'ungari': some fine paintings: two fine mirrors with ornaments: a microscope with augmented glass (Chick 1939, 491)".

The striking clocks made such an impression on the Safavids that they built a clock tower, which was mentioned in the travel accounts through the 17th and the beginning of the 18th century. Adam Olearius notes in 1637 that there is a clock tower at the entrance of the Bazaar of Isfahan (Emami 2024, 74). J. Tavernier (1677) also claims that the Englishman Feste devised a striking clock at the entrance to the Bazaar during the reign of Shah Abbas. J. Chardin (1711) also joins these mentions about the clock: The clock does not

work because there is no one to repair it, and they hate its sound, which their religion forbids. But in 1704, De Bruyn reports that there is only one striking clock in Bazar-i Qaysariyyah of Isfahan (King 1999, 290). In 1650, Shah Abbas II ordered the erection of a clock pavilion in Isfahan, which was described in Chardin's notes. He shows that the moving figures like heads, arms, and hands, also birds, and wooden animals with musical instruments made an impression on the Safavid spectators when it struck every hour.

It should be noted that despite heliocentrism gaining general acceptance in Europe, the Safavid Empire continued to adhere to geocentric principles. Copernicus's theories prompted Safavid scholars such as Muhammad Baqir Majlisi (1627–1699), whose treatise is housed in Cairo's Dar al-Kutub library, to refute heliocentrism. Why did he need to write this treatise? The new model, heliocentrism, was a direct threat to the generally accepted Ptolemaic geocentric model, which formed the basis of traditional cosmology and astrology, especially hemerology (the traditional practice of linking the success or failure of actions with favourable or unfavourable days determined by the calendar). Even the treatise of Muhammad Baqir Majlisi on hemerology, entitled Ikhtiyarat al-ayyam, was very popular among locals, and he stated that during the writing of this work, he benefited from the books of Shiite clerics and pre-Islamic authors (Arjomand 1997, 11)

Conclusion

In the 17th century, encounters between Catholic missionaries and the Safavid world created shared spaces for the transmission and reinterpretation of knowledge. Despite the contradictions between the two faiths, the exchange of scientific instruments and the celestial dialogues reflected a process of mutual exchange rather than one-way transmission. It is important to note that the clash between European heliocentric ideas and the predominantly geocentric model of Safavid science gave rise to moments of

intellectual tension, reflected in both written treatises and the exchange of scientific instruments. For instance, we can observe the refutation of heliocentric ideas in Shah Suleiman I's attitude towards the mechanical device (planetarium) made by the Danish astronomer Ole Roemer and presented to the Safavid monarch by the French envoy François Piquet in 1682. During this reception, he summoned the royal astronomers, and they claimed the Sun rises and sets every day, but the Earth is immobile, from which it was clear that Copernicus had made a mistake. Thereupon, the Safavid shah ordered that this device be taken to Qalayi-Tabaruk, which served as a storage facility. The clock showing the movements of the planets also faced the fate of the planetarium because it was based on the heliocentric model. According to Kaempfer, this clock was presented on behalf of the Swedish King (Kaempfer 2018, 45). By foregrounding the role of science in these encounters, this study highlights how astronomy and related disciplines served as a bridge between cultures, facilitating dialogue and fostering intellectual connections across Safavid and European contexts.

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