

INDIAN ATTITUDE TOWARDS EUROPEAN INNOVATION DURING THE PERIOD OF THE MUGHALS

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“Mughals are unwilling indeed to adopt manners and customs of the Portuguese; Yet do they readily learn their manufactures and workmanship, being all very Curious and desirous of learning.”

Francis Pyrard de Laval¹

Introduction

The Indian encounter with Europeans was a notable episode that opens an engrossing chapter of diffusion of innovations in Indian Ocean. There was a class of vogue for overseas rarities among the Mughals and the nobles to gratify their inquisitiveness. However, starting their journey from the south coast, these newcomers established themselves firmly in the empire of the Moors. Trading contacts provided the means of exchange and thus led to new ways of development in the field of technology. This cross cultural encounter of these two civilizations gave rise to the flow of “embracing and rebuff” of number of phenomenon in this area that came into contact through the medium of ‘gifts’, ‘fascination’ or ‘trading contacts’ that is the hypothesis of the present study.

The charisma of Europe towards India paved the way for the coming of Europeans as missionaries, traders, travelers, ambassadors and adventurers. Indian reaction towards European novelties during the period of the Mughals is a subject of keen interest. It seems in the records of the contemporary chronicles that not only the Mughals but also ‘court circle’ welcomed and

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¹ *The Voyage of Francis Pyrard of Laval to the East Indies, the Maldives, the Moluccas and Brazil*, tr. and ed. by A. Gray Hakluyt Society, London, 1887-90, p. 249.

expressed greater interests in the European rarities that were brought by these newcomers with the aim of multiple reasons.

In this article an attempt has been made to read the mind of the Mughals towards European novelties as recorded in the contemporary chronicles. This work tries to make a brief survey in limited spheres i.e. the acceptance or rejection of mechanical clocks, looking glasses, spectacles, globes, some techniques of shipbuilding and telescopes under the sway of Europeans. In the course of exchange it is quite noticeable, why did Indian seems “picky” in adopting the European techniques that could be helpful in the development of Indian technology? What does Indian reaction towards this ‘reception or rebuff’ towards foreign elements signifies?

In this context, first endeavor was made by Emperor Akbar (1575), who sent Haji Habibullah to the port of Goa to acquire the excellent art and rarities of European.² During the period of Akbar when direct contact was established between these two civilizations, European stuff was demanded by the Mughals and was utilized by them. For instance- Writing in 1579, Arif Qandhari informs us about Akbar’s interest in European technology:³

*“His high and majestic nature is such that when he journeys, the tents of His Majesty’s Encampment is loaded with on five hundred camels. There are eighteen houses, which have been made of boards of wood, each including an upper chamber and balcony that are set up in a suitable and attractive place. At the time of departure, each board is dismantled and at the time of encamping the boards are joined together by rings. The insides of these houses are clothed covered by **European velvet** and the outside there of are covered by broadcloth.”*

In this way, the credit for introducing the ‘sand glasses’ in India was also given to the Europeans. However, there is no clear mention of its use in Indo-Persian literature but we get some sort of its depiction in the paintings of the Mughal period as early as 1590, mainly used for the astrological

²Abul Fazl, *Akbarnama*, trans. by H. Beveridge, Asiatic Society of Bengal, Calcutta, 2000, p.322.

³ Arif Qandhari, *Tarikh-i-Akbari*, ed. Moinuddin Nadvi, Azhar Ali Dihlawi and Imtiyaz Ali Arshi, Rampur,1962, p.43. C.f. Habib,I. ‘Akbar and Technology’, *Journal of Social Scientist*, Vol.20, 9-10, September-October,1992, p.2.

reason. For instance- while giving birth to a prince.⁴The more information was available in this regard in the account of Manucci, describing the arrangements in the Mughal army he informed that “there was a man on foot, incharge of hourglass and thus measures the time and each time announces the number of hours with a mallet on a platter of Bronze.”⁵Then in 1668-72 John Marshall viewed the presence of hourglasses like that of England, and named it *gurry*.⁶ Later, sand glasses of 24 minutes, equal to one *ghari* of Indian unit came to be manufactured during the second half of the 17th century. This is one of the important instances of Indian artisan trying to adopt it.

Further, the mechanical clocks such as sun dials, clepsydras, sand glasses, and watches were preferred as the time reckoning devices. During the sixteenth-seventeenth century clepsydras emerged as the chief apparatus for measuring time in India.⁷ It seemed in 1613, Indians received clocks from England. In 1616, Sir Robert Shirley presented a silver clock to the emperor Jehangir and then Thomas Roe also gave a clock along with two trifles as a present.⁸ In this respect Otto Kurz reported that in 1616, for the first time Shah Abbas sent the clocks to the Mughal Court as a gift to Emperor Jehangir.⁹

It seems in historical records that Richard Steel arrived in India with an artist (Haltfield) and a clockmaker with the aim to attain the patronage of Jehangir. But the lack of interest in Indians were noticed by Ovington in 1689 as: “The Indians have not yet attempted an imitation of our clock-work in watches and maybe it is, because they seldom continue their just motions for long time, by reason of the Dust that flies continually in the Air which is apt to clog and stop the wheels.”¹⁰ He further informed about the use of waterclock in India, by stating that water clock

⁴ Hajeck, L. *Indian Miniatures of the Moghul School*, Spring books, London, 1960, plate, 18. In this plate one can see an hour glass in the hands of an astrologer. This is an authoritative book on Indian miniature paintings of the 17th century.

⁵ Niccolo Manucci. *Storia da Mogor 1653-1708*, vol.ii, Albemarle Street, London, 1907, p.70.

⁶ Qaiser, J.A. *Indian Responses to European Technology and Culture (A.D.1498-1707)*, Oxford University Press, Delhi, 1982, p.76.

⁷ *Baburnama*, tr.A.S.Beveridge, vol.ii, reprint, New Delhi, 1970, p.516.

⁸ *The Embassy of Sir Thomas Roe to India 1615-19*, ed. by W. Foster, Asian Publishers, Jalandhar, 1993, p.115.

⁹ Kurz, O. *European Clocks and Watches in the Near East*, Leiden, Netherlands: Brill, 1975, p.64.

¹⁰ Ovington, J. *A Voyage to Surat in the year 1689*, ed. by H. Rawlison, Oxford University Press, London, 1929, pp.166-167.

called *ghari* is still used in Hindu marriage ceremonies. It takes 24 minutes to fill the pot.¹¹ Although this explanation did not seem a satisfactory one. However, in this context, Bernier informed that “A high steeple stood upon this church with a bell whose sound was heard in every part of the city.”¹² Further in *English Factories*, it is recorded that the English were asked for a clock “to strike after the moors fashion.”¹³ These facts show the presence of clocks in diverse aspects as an article of “fascination” for Indians but one can find that there is a noticeable difference in the arrangement of timings of Europe and India.¹⁴ Needham gave the reason behind the rejection of this device is the weight drive and escapement; these two features of ordinary clock were not known in Mughal Court.¹⁵ Besides Indian interest in the clocks, it did not acquire the patronage of the reigning monarch as Jehangir already refused to patronize the clock men.

Same as the case of European looking glasses, this is among one of the merchandise that were listed in better requirement and imported from Europe by the Portuguese.¹⁶ In 1608, William Finch describing the luxuries of court informed: the King’s room splendidly covered with pure gold, where also placed faire ‘Venice looking glasses’ on the walls.¹⁷ In the letters, while writing to Paul Canning, Mr. Aldworth wrote about that he gave 100 broad cloths and 12 chests of rials and two sets of looking glasses. Further it is quite interesting to note that Muqarrab Khan wished for the essentials from England in which he also listed ‘the greatest looking glasses’ that may be got and also all mode of toys that may pleased the King.¹⁸ In 1614 it is mentioned: “All sea port governors had express commandment from the Mogoll [Emperor Jahangir] no to suffer any trade

¹¹Ibid., p.167.

¹² Francois Bernier, *Travels in the Mogol Empire A.D.1656-1668*, tr. by A. Constable, Columbia University Press, London, 1966, p.177.

¹³*Letters received by the East India Company from Its Servant in the East*, ed. by William Foster, vol. iii, Sampson, London, 1899, p.88.

¹⁴The Indian system had 60 'hours' of 24 minutes to the full day, the European consisted of 24 hours of 60 minutes. Obviously, European clock would not have served any purpose for Indians unless they adopted the European system of 12 equal double-hours, and modify it to bring the clock in line with the Indian way of measuring time, just like the Chinese did. E.Terry, *A Voyage to East India, &c., 1616-19, London, 1665*, p. 31. Tavernier gave two watches as a gift to a Mughal noble and an eunuch of Princess Jahan Ara that costs 480 and 174 rupees respectively. But it does not seem quite strong reason. See, Op.cit. *Indian Responses to European Technology and Culture*, p.68.

¹⁵ Needham, J. *Science and Civilization in China*, vol. iv, George Allen & Unwin LTD, Cambridge, 1977, p.441.

¹⁶Op.cit., *Indian Responses to European Technology and Culture*, p.71.

¹⁷*The Early Travels in India 1583-1619*, ed.W.Foster, Oxford University Press, London, 1921, p.164.

¹⁸Op.cit. *Letters received by the East India Company from Its Servant in the East*, vol.ii, p.183.

with us till they had made choice of all strange things that we bring, and they to buy them for the Kings use and to send it unto him.”¹⁹

In 1614 Thomas Kerridge also wrote to Captain Downton while concerning about their trade that they have pictures, combcases, looking glasses, spectacles and burning glasses but they are for presents not for sale.²⁰ Asaf Khan also listed among the nobles who procured these wares from an Italian.²¹ In 1609, an Englishman also wrote to his official at Surat that some faire large looking glass pleased the king, as for this king not the value but the rarity in everything matters.²² These statements refer the use of looking glasses only as a piece of decoration for the palace and the part of amusement for the Emperor where no attempt seems to mention for its manufacture. Further in 1683, there are several instances where looking glasses were given to high officials like that of Amil of Patna (cost 3 rs), Mir Bahar of Patna (costs 2rs).²³ There is also mention of present (looking glasses) given to Dara.²⁴

The historical background of the invention of spectacles in Europe were dated back to the thirteenth century with convex lenses and then its development with concave lenses in the later centuries, while in India the manufacture of crystal lenses were dated back to seventh century by Yuan Chwang.²⁵ P.K.Gode informed us the earliest evidence of the use of glass spectacles in Vijaynagar Empire gifted by a European.²⁶ Firstly, it was reported that Father Rudolf Acquaviva, the missionary at the time of Emperor Akbar, used the spectacles.²⁷ Further, Akbar’s court Poet Faizi mentioned ‘glass spectacles’ i.e. *ainak-i-shisha*.²⁸ In 1606, the English factors at Surat sent a large amount of commodities for sale including spectacles. Further, in letters written to EEIC it is stated that Agra was not a good place for the sale of the commodities like comb cases, spectacles, burning glasses and the conyskins. Only thing which were found here in abundance

¹⁹ Op.cit., *Indian Responses to European Technology and Culture*, p.7.

²⁰ Op.cit., *Letters received by the East India Company from Its Servant in the East*, p.193.

²¹ William Foster, *A Supplementary Calendar of Documents in the India Office relating to India or to the Home Affairs of the East India Company, 1600-1640*, Oxford, London, 1928, p.83.

²² Op.cit., *The Embassy of Sir Thomas Roe to India*, p.76.

²³ Op.cit., *A supplementary Calendar of Documents in the India Office relating to India*, p.243.

²⁴ *English Factories in India 1642-45*, ed.by W.Foster, Oxford, London, 1905, p.160.

²⁵ Op.cit., *Science and Civilization in China*, vol.iv.(i), pp.118-21.

²⁶ P.K.Gode, ‘Some Notes on the Invention of spectacles and the history of spectacles’, *The journal of Studies in Indian Culture History*, vol., ii, pl.2. C.f. *Indian Responses to European Technology and Culture*, p.75.

²⁷ Monserrate, Fr S.J., *Commentary on his journey to the court of Akbar*, Oxford University Press, 1992, p.193.

²⁸ Habib, I. *Technology in medieval India c.650-1750*, Tulika Books, New Delhi, 2013, p.67.

were cloth and indigo in exchange of money.²⁹In 1625, Asaf Khan asked for some English spectacles which were duly forwarded him. However, Mughal paintings gave few depictions regarding them. In 1683, the English factors at Patna: gave spectacles as a gift to munshi of the nawab of Patna and Emperor's diwan, mutasaddi of diwan and many more officials in that region. The prices of these pairs seem low that is manageable enough to purchase i.e. one rupee and twelve paise in one of the above mentioned cases. The Patna diary recorded the purchase of these spectacles high in comparison to other novelties brought from Europe.

Another important innovation of Europe that represented the interest of Mughal's is Terrestrial globes. They were used by the European overseas ships during the seventeenth century. The English gave them as presents to the Mughal Emperors, princes and nobles. A globe came into sight as an icon in Painting during the reign of Jehangir, showing a sketch map of Asian countries. (See fig.1.) But the use of globe just remained within the subject of peculiarity.

Finally, some sort of relaxation seemed in European shipbuilding technology adopted by the Mughals. However one could not be able to justify the Indian reaction towards this technology in one word as this innovation include various aspects like pumps, cables, tanks, iron anchors ,caulking etc. The interesting thing is that the response to each facet varies in nature depending upon its use, accessibility, comfort and profit. This paper briefly gives an outline of the Indian approach towards this innovation. For instance- when we talk of the internal structure of shipping for the storage of water then it is recorded by Abul Fazl that *karrani* had the duty for providing fresh water but he does not tell us how the water was stored in the ships. To clarify this query *Anis-ul-hujjaj*, a travelogue referred to *fintas*³⁰ that signifies a 'tank' for the storage of water. Further the travelers carried their own container for the storage of water. While the Europeans used 'four cornered wooden cesterne' was not adopted by Indians because of its low capacity of storage of water.

²⁹Op.cit., *Letters received by EEIC*, vol vi.,p.201.

³⁰Safi bin Wali Qazwini, *Anis-ul-Hujjaj*, transcript in the Department of History, Aligarh Muslim University, Aligarh, p.12.

At some places we also find the interest of Indians in European ships, and therefore Indians demanded ships like the Christian manner.³¹In 1670-3, Europeans appreciated the Indian carpenters.³² Further Muqarrab Khan seemed to be demanded by English to provide with a model of a “chain pump.”The reason behind the use of chain pumps was that it took large amount of water in comparison to ordinary.³³There is no evidence of its manufacture in India. Apart from it caulking, sheathing, cables and cordages did not create a significant consideration of Indians. It is also noticed that the Indian method of “rabetting” also drew the attention of European which was proved far better than their method of caulking.

It is merely from the seventeen century that we came across the sparkling response to iron anchors in ships. *Farangh-i-Jahangiri*, a vocabulary prepared during the reign of Emperor Jehangir refers to *langaras* made of iron in order to save the vessel moving away.³⁴ While in eighteenth century lexicon *Bahar-i-Ajam* reported *langar* as a heavy piece of iron also used for the same purpose. Then we also find the evidence of use of iron anchors i.e. *langar-i-ahni* in 1720s in a diary, *Mirat-ul-haqaiq*. Therefore, these evidences show that Indians initiated the making of iron anchors.

In this regard, Thomas Bowery stated : “the best Iron upon the coast is for the most part vended here and at reasonable rates with the workmanship also; and sort of ironwork is here ingenuously performed by the natives, as speeks, bolts, anchors.”³⁵Therefore, it might be right to say this case of shipbuilding is said to have “picky” response that means not all the techniques but some selective units of making ships were adopted.

Besides the reaction towards these innovations, let us make an inquiry towards the reception or rebuff of telescope in the Court of Mughals? Does this new invention proved helpful in improving the nature of astronomy in the Indian Ocean?

³¹Op.cit., *English Factories in India 1642-45*, p.168.

³²John Fryer, *A new Account Of East India Persia being Nine Years Travels*, The Hakluyt Society, London, 1985, p.267

³³Op.cit., *Science and civilization in China*, p.667.

³⁴Op.cit., *Indian Responses to European Technology and Culture*,p.27.

³⁵Ibid.,p.28.

The historical evidences illustrates the presence of telescope in India during the reign of Emperor Jehangir i.e. 'burning glasses and prospective' presented by Thomas Roe, moreover his nobles also seemed curious in acquiring it.³⁶ This presence of telescope only signifies it as an item of present not its use in astronomical purpose. However, being a scholar Jehangir promoted the translations of Sanskrit into Persian, as well as Hindu Scholars who wrote on Hindu Law, science and lexicography.

Further, in the court of Shah Jahan we find the presence of Fariduddin Munajjam, a court astronomer who was basically interested in the compilation of *Zij-i-Shah Jehani*. The initial portion dealt with the various calendars, then another portion gave the details of spherical astronomy and the last one informed us about the motions of the planets and their position in the sky. These facts show the advancement of astronomy in the Mughal court but not with the help of European telescope.

Now, we have the highest-flying icon in the field of astronomy i.e. Raja Sawai Jai Singh, whose interest in this perspective gave rise to *Zij-i-Muhammad Shahi* divided into three *maqalas*. In (1699-1743) it came into light that Raja Sawai was aware of using telescope but *Zij-i-Muhammad Shahi* reveals that Sawai knew the capabilities of this instrument but lack in taking data with the help of telescope. It is reported in *Zij*: "the telescope is now constructed in our kingdom. The telescopes enable one to see bright stars in broad daylight, say around the noon hour. It is also mentioned that the telescope is not readily available to an average man."³⁷

In spite of this fact, the interesting fact about Sawai is that he was the follower of the geocentric model of planetary motion instead elliptical orbits. He did not apply the heliocentric system but was aware of it, as the atlas contained the charts on the theory of *Copernicus, Riccoli system* given by Johan Baptist Hoemann.³⁸ In *Zij*, we also find European concepts as the theory of

³⁶Op.cit., *The Embassy of Sir Thomas Roe to India 1615-19*, p.117. It was seen that nobles like Asaf Khan was taken interest in European devices. Further, we have Rustom ji, Shaista khan who were also curious for European rarities and brought telescopes. See, J.B.Tavernier, *Travels in India*, tr. V.Ball, vol., i, Macmillan & Co., London,1889, p.230.

³⁷MSS. *Zij-i-Muhammad Shahi*, Maulana Azad Library, Aligarh, Fasiya Ulum,No.30.This manuscript is a set of astronomical tables, which could help astronomers in computing the occurrences of celestial phenomenon Ibid.,f.189.

³⁸ Ansari, Razaullah, S.M., *Introduction Of Modern Western Astronomy In India During 18-19 Centuries*, Institute of History Of Medicine and Medical Research, New Delhi, 1985, pp. 6-7.

motion of the sun and the statements like the orbit of the sun is oval in shape that suggests the author of the *Zij*³⁹ possessed the knowledge of Kepler Laws.⁴⁰ These evidences demonstrate an amalgamation of different elements i.e. Hindu, Abbasid and European astronomy in the environment of the Mughals. In the middle of the eighteenth century it is reported by lexicographer: *durbin* (two fold use of telescope) as an instrument by pilots and recognizing the position of enemy soldier.⁴¹ This evidence clearly indicates that Sawai possessed the knowledge of using and making telescope but did not clarify its use in carrying out astronomical purpose as Sawai seemed interested in European Astronomy but he was the follower of ulugh Beg concept (an unanswered query).⁴²

Besides this, it is also seemed that there was an unremitting swap of European scientific ideas in the field of medicine and education. During the reign of Aurangzeb, Francois Bernier was appointed as the court physician. It is imperative to discuss here, the case of Danishmand Khan that shows how Indians seemed independent in “rejection” if they did not like the foreign theories. For instance, Bernier taught anatomy and the circulation of blood advocated by William Harvey (1578-1657) to Danishmand Khan. He also knew the concept of circulation of blood in sheep but failed to impress him. Khan remained on the ideology of Galenic and Avicennean views of Indian Hakim.⁴³

To sum up, the queries of the present paper on the basis of historical evidences it may be right to state that Indian reaction in adopting the European innovations seem independent. It was quite accepted for a regular and brawny cultural interaction to grow, exchange and thus led to diffusion of number of innovations. But the case of Mughals in this respect was quite exceptional. For Mughals, they were the items of ‘presents’ and ‘curiosities’ mainly came out as

³⁹ Op.cit., *ZMS*, f. 132.

⁴⁰ Kepler describes the orbits of the planets to be elliptical that is based on the heliocentric concept of solar system. See, Sharma, N. V. *Sawai Jai Singh and His Astronomy*, Motilal Banarsidas Publishers, 1996, p.244.

⁴¹ Op.cit., *Indian Responses to European Technology and Culture*, p.35.

⁴² His interest in European astronomy clarifies by the replacement of Muslim astronomers by European. He also sends mission to Europe. The delegation was led by Fr. Figuredo, reached Portugal in January 1729 to solve the queries regarding the astronomical tables used in Portugal and India and to learn about the new and old instruments of astronomy. Op.cit. *History of Oriental Astronomy*, p.237.

⁴³ Op.cit., *Travels in the Mogol Empire 1656-68*, pp.324-5. For *tabib*, See, op.cit., *Storia da Mogor*, p.333. He advocated that the *tabibs* of India had no knowledge of medicine. for more information see, Op.cit., *A new Account of East India and Persia in Eight Letters being Nine Years Travels Begun 1672- 1681*, p.114 .

a source of amusement. However, some techniques were adopted by the Mughals if they considered it significant for the development in that particular field. Finally, this conclusion seems more valid by the remark of Ovington: “The Indians are in many things of matchless Ingenuity in their several Employment and admirable mimicks of whatever they affect to copy after.....”⁴⁴



Jahangir representing “Globe” as a symbol of power.

⁴⁴ Op.cit., *A Voyage to Surat*, p.168.