

Mathematics in Indian Knowledge Systems - Correcting Wrong History

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The Concept of Navigation and How the West Learned from India: Vasco da Gama and Other Scholars' Encounters with the Subcontinent

Introduction:

Navigation, the science and practice of determining a vessel's position and course across the seas, has been one of the most significant developments in human history. Over the centuries, various cultures around the world found ways to cross great oceans of water, which were crucial for trade, exploration, and conquest. While the Western explorers such as Vasco da Gama are celebrated for their groundbreaking voyages in the Age of Exploration, it is important to note that their success was not solely the result of their innovations. Much of the knowledge they relied on, especially in terms of navigation and astronomy, was derived from earlier cultures, most notably India. The maritime practices of Indian sailors and the sophisticated knowledge that they had accumulated over centuries played an instrumental role in helping European navigators successfully chart new routes to India and beyond.

The Age of Exploration, which started in the late 15th century, was a period when European powers, especially the Portuguese and the Spanish, sought to expand their influence by finding new trade routes and establishing colonies across the globe. While the West had been navigating along the coasts of Europe for a long time, their journeys beyond the Mediterranean were limited by the lack of geographical knowledge, the absence of navigational tools, and unfamiliarity with the open ocean. India, with its centuries-old maritime traditions, became a source of knowledge, especially for the Portuguese explorers who first ventured into the Indian Ocean in the late 15th century. Vasco da Gama's landmark voyage to India in 1498, which gave rise to the Portuguese establishment of a sea route to the East, is an important point in the history of world exploration. Yet to comprehend the significance of India's contribution to Western navigation requires a view of the intellectual and technological exchanges that were occurring between the East and the West during this period.

This essay will explore the notion of navigation, how the West learned from India, and the impact these interactions had on the growth of Western maritime exploration. Indian sailors, scholars, astronomers, and the voyages of figures such as Vasco da Gama all bring light to how European navigators not only learned how to reach India but also how to perfect their knowledge of the seas and skies.

The Concept of Navigation :

The history of navigation is so closely interwoven with the history of human civilization itself. Since ancient times, different cultures have developed methods of navigating across rivers, seas, and oceans. Ancient Egyptians, Phoenicians, and Greeks all contributed to the development of maritime skills, but it was the navigational practices of the Indian subcontinent that would have a lasting impact on European exploration in the 15th and 16th centuries.

India's maritime history dates back to the ancient period when its civilization flourished along the coasts of the Indian Ocean. Ancient Indian sailors were pioneers of long-distance sea travel, regularly sailing to Southeast Asia, Arabia, and Africa. They had a deep understanding of the monsoon wind patterns, which they had used for centuries to time their voyages. These predictable seasonal winds made long-distance travel across the Indian Ocean not only possible but relatively safe for those who understood them.

Unlike the Mediterranean, where winds were less predictable and sailors had to rely more on navigation along the coastlines, the Indian Ocean presented an entirely different challenge. They had to cover vast expanses of open waters, with sophisticated celestial navigation skills required, in addition to highly accurate wind and ocean currents' knowledge. Advanced tools used by the Indians included an instrument to measure the altitude of celestial bodies known as the astrolabe, as well as kamal for latitude measurement. That knowledge would prove vital for later European sailors, who, however, entered Indian waters having learned open-ocean navigation on a scale that would be required to return across the oceans from the point of transcontinental discovery.

Besides celestial navigation, Indian sailors were also adept at dead reckoning, which is the process of calculating a ship's position by estimating speed, direction, and time travelled. Though not as accurate as later methods of navigation, dead reckoning was essential in navigating unknown waters. Indian sailors used landmarks, ocean currents, and even bird migrations to estimate their position when they could not rely on the stars.

Perhaps the most important knowledge of Indian navigation, however, was the knowledge of the monsoon winds. The Indian subcontinent is uniquely positioned between two seasonal monsoons-the southwest monsoon (from June to September) and the northeast monsoon (from November to March). Indian sailors had learned to navigate these winds, which were strong and predictable, allowing them to travel vast distances between ports in India, Arabia, Africa, and Southeast Asia. The seasonal nature of the winds meant that sailors could time their voyages with great precision, ensuring that they reached their destinations during the optimal window for navigation. This knowledge was a valuable commodity for European explorers, who had little experience with the monsoon winds when they first arrived in the Indian Ocean.

The West's Maritime Challenges and the Search for New Routes :

By the late 15th century, European maritime powers were motivated by the desire to find new routes to India and the East Indies, particularly in search of spices. The Ottoman Empire's control of overland trade routes had made it difficult for Europeans to reach the East by land. The Portuguese, under the guidance of Prince Henry the Navigator, were among the first to pursue a sea route around Africa to India. In the early stages of their explorations, they sought to bypass the overland routes controlled by the Ottomans by finding a direct sea route to the East.

This was a period of discovery that is popularly known as the Age of Exploration. During this time, Europeans sought to cut through the Middle Eastern and Asian middlemen who controlled spice trade. The explorers would seek a direct access route to India and Southeast Asia in order to secure the spice trade monopoly and gain access to newly available economic routes. However, they needed to discover a dependable sea route to India for them to do this. However, since they were not experienced in the navigation of long distances in the ocean, they had many challenges along the way.

Portuguese explorers initially focused on the coast of West Africa, mapping out routes and seeking to understand ocean currents and wind patterns. The first important turn came in 1488 when Bartolomeu Dias rounded the southernmost point of Africa-the Cape of Good Hope-making the first European voyage to go round the southern tip of the continent. However, the journey that would truly open the sea route to India was a decade later with the famous voyage of Vasco da Gama in 1497-1498.

Vasco da Gama's Voyage to India :

Vasco da Gama's voyage to India is among the most famous and significant events in the history of global exploration. In 1497, da Gama departed from Lisbon with the intent of reaching the East by sea. He followed the route pioneered by Bartolomeu Dias around the Cape of Good Hope and then navigated the waters of the Indian Ocean, eventually reaching the port of Calicut on the southwestern coast of India in May 1498.

Da Gama's journey marked three moments of significance: it was the first successful sea voyage from Europe to India, thereby evading the requirement for overland trade routes and bypassing previous dependence on Arab merchants. Yet it must be grasped that da Gama would not have been possible without the vast experience that had been built up by Indian sailors and merchants.

Indian sailors had been navigating the Indian Ocean for many years, and it was through their experience that they were able to contend with the monsoon winds and celestial navigation, which helped Vasco da Gama in his voyage. Once Vasco da Gama and his crew reached Calicut, Indian merchants and sailors welcomed them and led them through the complexities of the maritime environment of that region. The local pilots that the Portuguese would receive during this time of journey helped in making their trip by allowing them to navigate the waters of the Indian Ocean. Local pilots could give very vital information concerning wind and currents as well as passage in the Indian Ocean that would determine the journey's success.

Da Gama learned crucial aspects of the navigation instrument, especially from Indians, that determined the success of his voyage. One of the tools used to measure latitude was the kamal, which the Portuguese borrowed during their stay in India. The Portuguese also learned how to use the astrolabe, an ancient instrument refined by Indian scholars to calculate the position of stars and determine latitude. These instruments were a crucial component in the development of Western navigation, particularly in assisting sailors to calculate their position in open ocean.

India's Impact on Western Navigation and Astronomy :

The Indian impact on the Western navigation was not the end of tools and techniques with which it used to voyage to seas. Indian contributions had profound effects on Western sciences too. Ancient Indian astronomers such as Aryabhata and Brahmagupta provided models based on mathematics for position, prediction of eclipses, and measures of time. Their works were influential not only in the Indian subcontinent but also in the Islamic world, translated into Arabic and later introduced to Europe. These texts helped shape the intellectual environment of the Renaissance in Europe and laid the foundations for modern Western science.

Indian mathematicians had developed advanced techniques for measuring angles and distances using the principles of trigonometry. Their mathematical methods proved invaluable to Western astronomers and navigators; they were adopted by these peoples and utilized to increase the accuracy of their navigation. Of particular relevance to the production of globes and maps used by European explorers, Indian scholars had gained a far more sophisticated understanding of spherical geometry.

In addition, the zero concept, which was brought to Europe through Indian mathematics, transformed Western arithmetic and provided a foundation for modern mathematics and technology. The Indian numeral system, which included the decimal place value system, gave Western mathematicians the tools they needed to do complex calculations that were essential for navigation.

The Lasting Impact of India on Global Exploration :

The impact of India's maritime and astronomical knowledge on European exploration was not limited to Vasco da Gama and the Portuguese. Over the centuries, the intellectual and technological exchanges between India and the West laid the foundation for the global system of trade and exploration that would dominate the modern world. The Portuguese, Dutch, British, and other European powers who established trading posts and colonies in India continued to benefit from the region's advanced knowledge of navigation and astronomy.

India's understanding of the monsoon winds, celestial navigation, and cartography enabled not only Vasco da Gama to reach India but also allowed him to look for new routes around the world. The flow of goods, ideas, and technologies during that period basically changed the global economy and the way the world was connected.

Conclusion :

The history of global exploration is inextricably linked with the knowledge that India gave to the West. The Indian sailors, merchants, and scholars were helpful to the Portuguese and other European explorers who ventured into the Indian Ocean during the Age of Exploration. India's knowledge of the winds of the monsoons and celestial navigation and astronomy played such a crucial role that Vasco da Gama and so many others after him started to chart new courses of travel to the East in ways that laid the basis for all the modern interconnectedness of trade, navigating, and scientific development.

While often perceived as an Age of European conquest and discovery, the Age of Exploration also represented an age of vast intellectual exchange. Indian contributions to Western navigation and astronomy led to profound developments in the science and the world economy in the modern world. The transformation of the West's navigational practice through the appropriation of maritime expertise from India facilitated the expansive global networks of the modern world.

In retrospect, the interaction and exchange between India and the West in the Age of Exploration were pivotal moments in world history. What the explorers such as Vasco da Gama had successfully done was not because of Western ingenuity but because of

centuries of Indian contribution to maritime and intellectual traditions. These exchanges not only defined the course of history but have also laid the foundation for the connected world we live in today.