Looking at the future, learning from the past

Apathy and complacency have been the two stumbling blocks in the development of the scientific temper in India.

by Jayant V. Narlikar

The era from Aryabhata to Bhaskara (5th-12th centuries) saw India enjoying a scientific temper far more advanced than that in Arabia or Europe. Scholars like Al Biruni visited India to learn Sanskrit so that they could translate the works of Brahmagupta and others into Arabic. So, the question arises: Why was the momentum of knowledge generation in science not maintained in India?

Nobel laureate Abdus Salam has also asked the question. He observed that the Taj Mahal was built in the 17th century, at around the same time that St. Paul's Cathedral was under construction in Europe. Both are landmarks in architecture and illustrate how advanced the subject was in these different regions. Within a few decades, England was undergoing a scientific revolution initiated by the discoveries of Isaac Newton. India, however, did not have any such development. Why?

LACK OF PATRONAGE

It is worth recalling here the grim fate that awaited the architect of the Taj Mahal. It is perhaps significant that his name is not reliably known, although he is believed to have come from Persia. The story goes that his hands were chopped off by Emperor Shahjahan to prevent him from replicating the Taj. Christopher Wren, the architect of St. Paul's, did not have to face any such difficulty. In short, although India produced an exquisite piece of architecture, its creation was not an enlightened move to promote creativity, rather it was aimed at boosting an emperor's ego.

It is in the matter of patronage that we notice differences between the nobility in India and Europe. In Europe some noblemen patronized science just as they patronized the arts. Thanks to such patronage, budding scientists could set up laboratories and observatories. Tycho Brahe's observatory in Uraniborg, Denmark, is an example. The king of France set up the Academie Francaise with a similar purpose.

In India, patronage existed for the arts, but nobody seemed to be aware of the emerging force of science.

Throughout the ages there have been numerous instances of artists, musicians and poets like Kalidasa and Tansen flourishing because of royal patronage, but there is not a single case of a scientist enjoying similar privileges.

COMPLACENCY AND FEWER DEMANDS

The Westerners used science as a tool to improve their standard of living, but the Indians, in the 16th to 18th centuries, hardly seemed aware of the potential of science. And if they were, they did not seem to care. It is not hard to find the sociological reasons for this apathy.

In Europe, the climate is harsh and considerable attention is given to surviving the bitter winters. This encourages a scientific temper and the use of technology thus becomes a way of life. By contrast, in the bulk of the Indian subcontinent, the extremes of weather are not so great and survival is relatively easy. Thus there is more complacency.

Of course, there were famines, limited and widespread, which claimed many lives. However, the religious outlook had already created a mindset that stressed not on life in this world, but in life hereafter. So long as one behaved righteously and suffered all privations calmly and bravely, great happiness was promised in the next life. Righteousness also included a simple life with no luxuries. This religious outlook, although it has its merits, took away whatever incentive one may have had for improving one's lot in the present existence.

Secondly, European colonization required undertaking long sea voyages in search of new lands. There were many hazards on the way and many people perished in the process. Once again people turned to science. The results speaks for themselves: the magnetic compass became a useful direction finder; gunpowder became the strongest defense against the native populations.

In fact, it was their failure to appreciate the force of science and technology that resulted in Indian rulers ultimately succumbing to the firepower of the East India Company. Although the British played the 'divide and rule' card with great astuteness, even without it, the fight between modern and relatively primitive technologies was obviously an unequal battle, despite the large human resources at the disposal of the Indian rulers. It was their technological superiority that helped the European settlers to eventually take control of the African and American subcontinents from the natives, who lacked a comparable level of science and technology.

Additionally, in India, the religious taboo on leaving the shores of the country made it extremely difficult for anybody to venture on long voyages like those undertaken by Christopher Columbus and Vasco da Gama. This also fostered a false sense of complacency. The Indians' passivity also prevented violent uprisings of the kind that led to the French Revolution.

Indeed, there is a remarkable lack of revolutions in Indian history, when contrasted with Europe, and the passive attitude has a lot to do with it. Even amongst the better off, the social perception is to respect those who live simply, rather than ostentatiously. So, if there is no great desire to live in an air-conditioned room at the height of summer, then why would anyone wish to explore how air can be conditioned?

The caste system with its four major divisions placed the thinkers, teachers and priests at the apex, followed by the rulers and warriors, with the farmers, traders and those who provided other services right at the bottom. This deprived a large section of the society of education, especially those who were faced with the practical problems of day-to-day existence. There was thus a greater premium on theorists rather than on practical workers.

In science, both theory and experiments must go hand-in-hand if there is to be any progress. Pure theory, with no supporting observations and experiments, degenerates into unproductive philosophy (no disrespect meant to philosophers *per se*). This was another reason why science in India could not proceed beyond the elementary stages. Even today, a glance at basic science in India shows a greater stress on theory than on experiments.

In this context it is worth recalling two episodes from Indian history. Nana Phadnis the efficient administrator of the Peshwâs, wanted to build a bridge on the river Karmanashi near Kashi. Attempts by Indian bridge builders were unsuccessful as the pillars of the proposed bridge kept on collapsing.

The person in charge initiated religious ceremonies to propitiate evil deities, but that did not help either. When Nana heard of this, he put a stop to the ceremonies and invited an English engineer named Baker, who brought suitable machinery for pumping out water and laying a firm foundation.

In the following century it was Ronald Ross, a British doctor, who probed the mystery of the origin and transmission of malaria that had been endemic on the subcontinent from time immemorial. Why should it have taken an 'outsider' to come and solve our problems?

Throughout the ages there have been numerous instances of artists, musicians and poets like Kalidasa and Tansen flourishing because of royal patronage, but there is not a single case of a scientist enjoying similar privileges.

ABSENCE OF PROFESSIONALISM

In the final analysis, it boils down to a question of mindset. In science, professionalism is essential. Perhaps Newton was so successful because he was a thorough professional. Although a loner and recluse, he was as conscious of issues of priority and credit for discovery, as he was of ensuring that his results were as accurate as possible. He was hardly popular among his neighbors or scientific colleagues, but he delivered and was respected for it.

In the 9th century in India, Adi Shankara (the first Shankaracharya), was just as professional as far as his mission of propagating the Vedic religion was concerned. He engaged in philosophical disputations with his opponents till he could defeat or convince them of his point of view. Persons of his caliber – who could take the next crucial step to understand, for example, why the planets move in the way they do; or for that matter, why a projectile sent up at an angle to the vertical falls down after describing a curved trajectory – were missing from the Indian scientific scene.

Even in the case of applied science, there seems to have been no incentive either from the rulers or from the intellectuals to explore worldly problems like how to make weapons more effective, or how to add to the comforts of the palace by inventing new devices. After the British came on the scene, their weapons were admired and purchased by Indian rulers for internecine warfare. But none of the rulers ever thought to encourage a local R&D effort to duplicate these weapons or to improve their performance.

ROTE LEARNING

Another problem was the manner in which students were taught in ancient and medieval India. We sometimes proudly boast that the Vedas are *Apaurusheyas*. That is, there was no human creator of these books of wisdom. The knowledge was passed from generation to generation orally. So, a teacher would have memorized them when he was a student, and would pass them on to his disciples at his own school.

When Adi Shankara was traveling from place to place, engaging philosophers and teachers from other disciplines in disputations, he was told that if he wished to propagate his point of view, he must hold a disputation with the famous scholar Mandan Mishra. On his way to Mandan Mishra's house, Shankara encountered a group of women washing clothes at a pond. When he asked them for directions, he received a poetic reply: "Where the pet birds in cages at the doorstep are found to be discussing whether the universe is with or without a deity, that is the house of Mandan Mishra."

No doubt this information was aimed at impressing Shankara. Indeed, anybody's first impression would be one of appreciation for the scholar whose teaching was so all-pervading that even the household pets imbibed it. However, from a modern standpoint it would appear that the birds picked up the jargon because they heard it from Mandan Mishra's students.

Birds like parrots pick up words if they are oft-repeated in their presence. So, one could infer that rote learning at Mandan Mishra's school had produced this effect on the pet birds.

Indeed, rote learning was the mode of study in those times and while it is useful and essential if traditional knowledge is to be passed on to the next generation, it is certainly not conducive for knowledge to evolve and prosper. With no additions to it, such knowledge will remain static and may become irrelevant in the course of time. For example, we have already seen that there is no universally-accepted and complete version of what is contained in the Vedas. Different people interpret them differently, some using the indefiniteness to argue that practically everything discovered by modern science today had been anticipated and put to use by our Vedic ancestors.

But apart from the emphasis on reproduction rather than understanding, the oral tradition was detrimental to the progress of science as it is practiced today. For, science progresses by moving further from the available knowledge base, adding to it with new experiments and new theories. If only what exists is to be taught and practiced, where is the scope for anything new? The irony is that it is precisely the same rote learning that dominates today's educational scenario where schools stress on mugging rather than on comprehension.

It is customary to glorify our past and recall our superiority of thought and action over the rest of the world. However, reality may not be so appealing to our collective ego. Even if the reader thinks the above comments too drastic, he or she may do well to be more self-critical and think of alternative reasons for why science did not flourish in India during the last millennium.

> Even amongst the better off, the social perception is to respect those who live simply, rather than ostentatiously. So, if there is no great desire to live in an air-conditioned room at the height of summer, then why would anyone wish to explore how air can be conditioned?

Jayant V. Narlikar is the founder-director of the Inter-University Centre for Astronomy and Astrophysics in Pune, India