

Early workings and modern science: some reactions to current happenings*

I am dismayed like many other Indians (some of whom are also professional scientists) at recent statements regarding signal achievements of science and technology in ancient India. These emanate from public figures as well as others. While freedom of thought and expression is an essential component of our polity, the probable influence of such statements on many of us, the consistency of the many instances, as well as their direct relevance for the nature of the scientific enterprise, have led to this reaction.

An aspect which is worrisome is the total implicit acceptance of a certain worldview, and the casting around for possible suggestive instances in the Indian context. These are identified with well-known features of modern science and technology, generally after the latter become well known. (A counterexample, absent in the current scenario, is the statement that the proton is a composite of three quarks, which themselves have internal structure. This was made by the famous theosophists, Annie Besant and C. W. Leadbeater in their book on *Occult*

Chemistry in 1908, nearly six decades before the observation. It is stated to be a perception originating in a different psychic state.) Such speculative connections and insights could be the basis of serious investigation and analysis. One such case is of the Sanskrit text *Vymanika Shastra* (published in the first half of the 20th century, well after the invention of man-made aircraft; there is no demonstrable connection with Maharshi Bharadwaja of classical Indian mythology, though such is stated and is extrapolated to claim a five millennium antiquity for the content of the book). This book describes several kinds of flying machines. The conclusions of the investigators are that the devices are 'poor concoctions'. Assertions of such identifications or connections largely hurt the professed cause by becoming easy targets of ridicule.

Another troubling fact is that some of the undoubtedly great achievements in science and technology are not mentioned, let alone highlighted. Some random examples are discoveries in mathematics, including that of differential calculus (about 150 years before Newton, who is universally credited with it), achievements in ferrous and nonferrous metallurgy, and remarkable surgical

accomplishments such as rhinoplasty. (Of course, these singular achievements do not amount to the about four-century-old tradition of Baconian modern science which envelops us all.) I think that our national academies, as representative bodies of scientists in the country, should take the lead in putting together such instances as a positive step.

I am saddened to see this in a land whose ancient culture (sought to be espoused) is fundamentally experiential/experimental. I recall the words of Swami Vivekananda who was a fierce agnostic in his early youth and evolved into a 'cyclonic monk': 'All our knowledge is based on experience. This includes scientific knowledge, which is of the outer world, of external nature, and religious or spiritual knowledge, which is of the inner world, of our inner nature.'

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Good fences make good neighbours*

There has been quite a debate during the last several weeks about science in ancient India. On the one hand, unverifiable claims are being made that many of modern-day ideas, discoveries and inventions in science (e.g. stem cell biology) were already known and practised centuries and even millennia ago in India. On the other, outright dismissal of even claims where written material can be checked (*Baudhayana* and *Apastambha Sutras* in mathematics) has the danger of throwing the baby with the bathwater. The debate is worryingly turning partisan and political, and it is time that we take a

perspective view of the issue.

Every civilization has been enriched over time through imagination, individual and collective thought and creativity. These have led to the blossoming of art and culture, mythology and symbolism, epics and belief systems, which have given it identity. They have also led to developments and achievements in logic, analytical thought, science and technology, which have offered human society improvement in daily life. *Cogito ergo sum*.

Imagination leading to arts and crafts, literature or mythology is often not limited to what is possible, feasible, familiar or 'natural'. Myths and epics abound in such unfettered thoughts and acts, and it

is these that lend them their special character and appeal. Great poems and epics of the Indian, Greek or other ancient civilizations have captured, triggered and nurtured peoples' imagination precisely because of this feature. The *Mahabharata*, told and retold over centuries, captivates the contemporary mind and even allows for interpretation of today's events. Such poems and epics have their own grammar.

Imagination, governed by rational and logical rules, and empiricism or heuristics, leads to developments in science and technology, making daily lives better. Science and technology have their own grammar, rules and restrictions. They do not allow, for example, creation

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of any material thing out of nothing. They thus define the 'natural', and the 'possible'. Town planners, mathematicians, metallurgists and architects of ancient India understood and practised this grammar as well.

Confusion and conflict arise when, for example, the symbolism of a myth or an event in an epic, which is perfectly admissible in its own context and narrative, is attempted to be in line with, and 'explained' using the grammar of science; or when what is symbolic is interpreted

to be literally true. Such an attempt to 'explain' Lord Ganesa's head through the method of science demeans His Divinity, reducing Him to a mere mortal.

Myths and symbols are meant not always to be explained by science; to do so would be an unacceptable trivialization. On the other hand, they may actually inspire science towards inventions and innovations. Each has its own value, and should be respected in its own right. There need be no 'correspondence principle' between the two. Without symbol-

ism and myths, it would be a duller world. Without science and technology, it would be a poorer world. Let us be enriched by both. But, let them not intrude on one another. As they say, good fences make good neighbours.

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The annual science farce

The 2015 Indian Science Congress is perhaps one of the most criticized activity and has raised questions about the relevance of this annual event. There was a time when scientific disciplines did not have their own associations and the Science Congress gave them a platform to meet and discuss their work and plan for the future. This objective has been lost and the platform is now used for political purposes. Jawaharlal Nehru was a man with a scientific temper and believed that science and technology are keys to India's development. Within his limits, he gave directions to the scientists and placed targets for them to achieve. Thanks to his vision, space science, atomic science and agricultural science

developed adequately. Unfortunately, after Nehru, the Prime Ministers who have graced the inaugural occasion have given little direction to the scientists. The 2015 Congress saw fun made of serious science by mixing scientific fiction with science by some scientists as well as politicians. Science fiction has a place but not in the Science Congress. The imaginative abilities have created mythology and descriptions of a man with an elephant head or a cow head and flying across planets, are all much appreciated. It is likely that some of these imaginary ideas have helped modern scientists to think and perform experiment. The imaginary descriptions of Julius Verne perhaps helped space explorations.

Hence science fiction has a place and helps modern scientists to think further before they perform experiments. However, to claim that we knew all this before the birth of modern space science or biotechnology, is absurd. If the Science Congress is to devote its time on such absurd discussions, it is better that the farce is stopped and each scientific discipline is asked to conduct its own meetings and discuss work instead of shaming Indian science and scientists before the world community.

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The missing 'crown' of India

The recent incident (14 November 2014) of showing a wrong map of India to the delegates, including the Indian Prime Minister during his visit to the Queensland University in Brisbane, Australia ahead of the G20 Summit that was reported by the media, has brought to the fore the discrepancies in the map of India available in the free GIS domain which had been ignored for the last several years.

The rapid growth of geographic information system (GIS) together with remote sensing (RS) has revolutionized many branches of science and humanities. They have become important tools

not only in the scientific and academic domain, but have increasingly attracted the government agencies and departments and the business community. At the heart of all these modern tools is still the good old survey map – now in its digital avatar (format).

Everybody who works with GIS and RS tools needs to start with maps, usually a political map of the area of interest along with topographic, road, drainage, habitation maps, etc. The GIS community does not create its own political maps, but depends upon survey organizations of a country, which are often Government agencies. Access to maps

prepared by these survey organizations is not easy (at least in India) – users not only have to pay, but do the necessary paperwork and await clearance to obtain them. If approved by the authorities, data is received. A fair amount of running around is needed to get data, which at times is only available in analogue format. This data is not usable directly – it needs to be digitized into computer-usable form. All these result in loss of time and effort that should have gone towards the real work. If, unfortunately, the area of interest is near the international boundary or sensitive installations, then getting data is much more difficult.